

LIGHT UNFLAVORED MESONS ($S = C = B = 0$)

For $l = 1$ (π, b, ρ, a): $u\bar{d}, (u\bar{u}-d\bar{d})/\sqrt{2}, d\bar{u}$;
for $l = 0$ ($\eta, \eta', h, h', \omega, \phi, f, f'$): $c_1(u\bar{u} + d\bar{d}) + c_2(s\bar{s})$

NODE=MXXX005

NODE=MXXX005

NODE=M014

 $f_0(500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

also known as σ ; was $f_0(600)$, $f_0(400-1200)$
See the related review(s):

Scalar Mesons below 1 GeV

$f_0(500)$ T-MATRIX POLE \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M014PP

NODE=M014PP

NODE=M014PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400-550)-i(200-350) OUR ESTIMATE (see Fig. 64.3 in the review)			
$(458 \pm 7^{+4}_{-10}) - i(245 \pm 6^{+7}_{-10})$	1 DANILKIN	21	RVUE Compilation
$(410 \pm 20) - i(240 \pm 15)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(512 \pm 15) - i(188 \pm 12)$	2 ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma 3\pi$
$(440 \pm 10) - i(238 \pm 10)$	3 ALBALADEJO	12	RVUE Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	4,5 GARCIA-MAR..11	RVUE	Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	4,6 GARCIA-MAR..11	RVUE	Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	7 MOUSSALLAM11	RVUE	Compilation
$(452 \pm 13) - i(259 \pm 16)$	8 MENNESSIER	10	RVUE Compilation
$(448 \pm 43) - i(266 \pm 43)$	9 MENNESSIER	10	RVUE Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	10 CAPRINI	08	RVUE Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	11 CAPRINI	08	RVUE Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	12 ABLIKIM	07A	BES2 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	13 BONVICINI	07	CLEO $D^+ \rightarrow \pi^-\pi^+\pi^+$
$(472 \pm 30) - i(271 \pm 30)$	14 BUGG	07A	RVUE Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..07	RVUE	Compilation
$(430) - i(325)$	15 ANISOVICH	06	RVUE Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	16 CAPRINI	06	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	17 ZHOU	05	RVUE
$(541 \pm 39) - i(252 \pm 42)$	18 ABLIKIM	04A	BES2 $J/\psi \rightarrow \omega\pi^+\pi^-$
$(528 \pm 32) - i(207 \pm 23)$	19 GALLEGOS	04	RVUE Compilation
$(533 \pm 25) - i(249 \pm 25)$	20 BUGG	03	RVUE
$517 - i240$	BLACK	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 30) - i(295 \pm 20)$	16 COLANGELO	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(535^{+48}_{-36}) - i(155^{+76}_{-53})$	21 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
$610 \pm 14 - i(310 \pm 13)$	22 SUROVTSEV	01	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(540^{+36}_{-29}) - i(193^{+32}_{-40})$	ISHIDA	00B	$\rho\bar{\rho} \rightarrow \pi^0\pi^0\pi^0$
$445 - i235$	HANNAH	99	RVUE π scalar form factor
$(523 \pm 12) - i(259 \pm 7)$	KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$442 - i 227$	OLLER	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$469 - i203$	OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$445 - i221$	OLLER	99C	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
$420 - i 212$	LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$440 - i245$	23 DOBADO	97	RVUE Compilation
$(602 \pm 26) - i(196 \pm 27)$	24 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
$(537 \pm 20) - i(250 \pm 17)$	25 KAMINSKI	97B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
$470 - i250$	26,27 TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
$387 - i305$	27,28 JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$420 - i370$	29 ACHASOV	94	RVUE $\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$370 - i356$	30 ZOU	94B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

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408 - $i342$	27,30 ZOU 93	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
470 - $i208$	31 VANBEVEREN 86	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$
(750 \pm 50) - $i(450 \pm 50)$	32 ESTABROOKS 79	RVUE $\dots \rightarrow \pi\pi, K\bar{K}$
(660 \pm 100) - $i(320 \pm 20)$	PROTOPOP... 73	HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$
650 - $i370$	33 BASDEVANT 72	RVUE $\pi\pi \rightarrow \pi\pi$

1 Data driven analysis using partial-wave dispersion relations.	NODE=M014PP;LINKAGE=P
2 S-matrix pole; 8595 events.	NODE=M014PP;LINKAGE=I
3 Applying the chiral unitary approach at NLO to the K_{e4} data of BATLEY 10 and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.	NODE=M014PP;LINKAGE=AD
4 Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.	NODE=M014PP;LINKAGE=GM
5 Analytic continuation using Roy equations.	NODE=M014PP;LINKAGE=GR
6 Analytic continuation using GKPY equations.	NODE=M014PP;LINKAGE=GC
7 Using Roy equations.	NODE=M014PP;LINKAGE=MO
8 Average of three variants of the analytic K-matrix model. Uses the K_{e4} data of BATLEY 08A and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73 and GRAYER 74.	NODE=M014PP;LINKAGE=ME
9 Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.	NODE=M014PP;LINKAGE=MN
10 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.	NODE=M014PP;LINKAGE=CA
11 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPESCU 73, GRAYER 74, and ESTABROOKS 74.	NODE=M014PP;LINKAGE=AP
12 From a mean of three different $f_0(500)$ parameterizations. Uses 40k events.	NODE=M014PP;LINKAGE=AL
13 From an isobar model using 2.6k events.	NODE=M014PP;LINKAGE=BO
14 Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.	NODE=M014PP;LINKAGE=BU
15 Using the N/D method.	NODE=M014PP;LINKAGE=AN
16 From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.	NODE=M014PP;LINKAGE=CL
17 Reanalysis of the data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.	NODE=M014PP;LINKAGE=ZH
18 From a mean of six different analyses and $f_0(500)$ parameterizations.	NODE=M014PP;LINKAGE=AB
19 Using data on $\psi(2S) \rightarrow J/\psi\pi\pi$ from BAI 00E and on $\Upsilon(nS) \rightarrow \Upsilon(mS)\pi\pi$ from BUTLER 94B and ALEXANDER 98.	NODE=M014PP;LINKAGE=GA
20 From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.	NODE=M014PP;LINKAGE=PS
21 A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.	NODE=M014PP;LINKAGE=KI
22 Coupled channel reanalysis of BATON 70, BENSINGER 71, BAILLON 72, HYAMS 73, HYAMS 75, ROSSELET 77, COHEN 80, and ETKIN 82B using the uniformizing variable.	NODE=M014PP;LINKAGE=SU
23 Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPESCU 73.	NODE=M014PP;LINKAGE=DO
24 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.	NODE=M014PP;LINKAGE=AA
25 Average and spread of 4 variants ("up" and "down") of KAMINSKI 97B 3-channel model.	NODE=M014PP;LINKAGE=E
26 Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.	NODE=M014PP;LINKAGE=B
27 Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.	NODE=M014PP;LINKAGE=G
28 Analysis of data from FALVARD 88.	NODE=M014PP;LINKAGE=C
29 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.	NODE=M014PP;LINKAGE=D
30 Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.	NODE=M014PP;LINKAGE=F
31 Coupled-channel analysis using data from PROTOPOPESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORNEN 79, BISWAS 81.	NODE=M014PP;LINKAGE=BV
32 Analysis of data from APEL 72C, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.	NODE=M014PP;LINKAGE=A
33 Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPESCU 73, and WALKER 67.	NODE=M014PP;LINKAGE=J

$f_0(500)$ BREIT-WIGNER MASS

VALUE (MeV) DOCUMENT ID TECN COMMENT

400 to 800 OUR ESTIMATE

••• We do not use the following data for averages, fits, limits, etc. •••

513 \pm 32	34 MURAMATSU 02	CLEO	$e^+e^- \approx 10$ GeV
478 $^{+24}_{-23} \pm 17$	AITALA	01B E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563 $^{+58}_{-29}$	35 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
555	36 ASNER	00 CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
540 \pm 36	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
750 \pm 4	ALEKSEEV	99 SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
744 \pm 5	ALEKSEEV	98 SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$

NODE=M014M

NODE=M014M
→ UNCHECKED ←

759 ± 5	37 TROYAN	98	5.2 $np \rightarrow np\pi^+\pi^-$
780 ± 30	ALDE	97	GAM2 450 $pp \rightarrow pp\pi^0\pi^0$
585 ± 20	38 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
761 ± 12	39 SVEC	96	RVUE 6-17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 860	40,41 TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165 ± 50	42,43 ANISOVICH	95	RVUE $\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
414 ± 20	39 AUGUSTIN	89	DM2

³⁴ Statistical uncertainty only.

³⁵ A similar analysis (KOMADA 01) finds 526^{+48}_{-37} MeV.

³⁶ From the best fit of the Dalitz plot.

³⁷ 6σ effect, no PWA.

³⁸ Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.

³⁹ Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^-\pi^+N$ on polarized targets. The fit does not include $f_0(980)$.

⁴⁰ Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

⁴¹ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$ decays.

⁴² Uses $\pi^0\pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+\pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.

⁴³ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

NODE=M014M;LINKAGE=UT

NODE=M014M;LINKAGE=KI

NODE=M014M;LINKAGE=KK

NODE=M014M;LINKAGE=TN

NODE=M014M;LINKAGE=AA

NODE=M014M;LINKAGE=E

NODE=M014M;LINKAGE=B

NODE=M014M;LINKAGE=GG

NODE=M014M;LINKAGE=F

NODE=M014M;LINKAGE=G

$f_0(500)$ BREIT-WIGNER WIDTH

NODE=M014W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
100 to 800 OUR ESTIMATE			

NODE=M014W

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

335 ± 67	44 MURAMATSU	02	CLEO $e^+e^- \approx 10$ GeV
324 ⁺ ₄₀ ± 21	AITALA	01B	E791 $D^+ \rightarrow \pi^-\pi^+\pi^+$
372 ⁺ ₉₅ ± 229	45 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
540	46 ASNER	00	CLE2 $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$
372 ± 80	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0\pi^0\pi^0$
119 ± 13	ALEKSEEV	99	SPEC 1.78 $\pi^-p_{\text{polar}} \rightarrow \pi^-\pi^+n$
77 ± 22	ALEKSEEV	98	SPEC 1.78 $\pi^-p_{\text{polar}} \rightarrow \pi^-\pi^+n$
35 ± 12	47 TROYAN	98	5.2 $np \rightarrow np\pi^+\pi^-$
780 ± 60	ALDE	97	GAM2 450 $pp \rightarrow pp\pi^0\pi^0$
385 ± 70	48 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
290 ± 54	49 SVEC	96	RVUE 6-17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 880	50,51 TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
460 ± 40	52,53 ANISOVICH	95	RVUE $\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
494 ± 58	49 AUGUSTIN	89	DM2

⁴⁴ Statistical uncertainty only.

⁴⁵ A similar analysis (KOMADA 01) finds 301^{+145}_{-100} MeV.

⁴⁶ From the best fit of the Dalitz plot.

⁴⁷ 6σ effect, no PWA.

⁴⁸ Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.

⁴⁹ Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^-\pi^+N$ on polarized targets. The fit does not include $f_0(980)$.

NODE=M014W;LINKAGE=UT

NODE=M014W;LINKAGE=KI

NODE=M014W;LINKAGE=KK

NODE=M014W;LINKAGE=TN

NODE=M014W;LINKAGE=AA

NODE=M014W;LINKAGE=E

NODE=M014W;LINKAGE=B

⁵⁰ Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

⁵¹ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$ decays.

NODE=M014W;LINKAGE=GG

NODE=M014W;LINKAGE=F

⁵² Uses $\pi^0\pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+\pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.

⁵³ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

NODE=M014W;LINKAGE=G

$f_0(500)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\gamma\gamma$	seen

NODE=M014215;NODE=M014

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

 $f_0(500)$ PARTIAL WIDTHS

NODE=M014220

$\Gamma(\gamma\gamma)$	VALUE (keV)	DOCUMENT ID	TECN	COMMENT	Γ_2
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NODE=M014W2
NODE=M014W2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1.37 ± 13	+0.09 -0.06	54 DANILKIN	21	RVUE	Compilation	
2.05 ± 0.21		55 DAI	14A	RVUE	Compilation	
1.7 ± 0.4		56 HOFERICH... 11		RVUE	Compilation	
3.08 ± 0.82		57 MENNESSIER 11		RVUE	Compilation	
2.08 ± 0.2	+0.07 -0.04	58 MOUSSALLAM11		RVUE	Compilation	
2.08		59 MAO	09	RVUE	Compilation	
1.2 ± 0.4		60 BERNABEU 08		RVUE		
3.9 ± 0.6		57 MENNESSIER 08		RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
1.8 ± 0.4		61 OLLER 08		RVUE	Compilation	
1.68 ± 0.15		61,62 OLLER 08A		RVUE	Compilation	
3.1 ± 0.5		63,64 PENNINGTON 08		RVUE	Compilation	
2.4 ± 0.4		64,65 PENNINGTON 08		RVUE	Compilation	
4.1 ± 0.3		66 PENNINGTON 06		RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$	
3.8 ± 1.5		67,68 BOGLIONE 99		RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
5.4 ± 2.3		67 MORGAN 90		RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$	
10 ± 6		COURAU 86		DM1	$e^+e^- \rightarrow \pi^+\pi^-e^+e^-$	

OCCUR=2

54 Using the value of the coupled channel analysis.

NODE=M014W2;LINKAGE=C
NODE=M014W2;LINKAGE=B

55 Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

56 Using Roy-Steiner equations with $\pi\pi$ phase shifts from an update of COLANGELO 01 and from GARCIA-MARTIN 11A.

NODE=M014W2;LINKAGE=HO

57 Using an analytic K-matrix model.

NODE=M014W2;LINKAGE=ME

58 Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

NODE=M014W2;LINKAGE=MO

59 Used dispersion theory. The value quoted used the $f_0(500)$ pole position of 457 - i276 MeV.

NODE=M014W2;LINKAGE=MA

60 Using p , n polarizabilities from PDG 06 and fitting to $\pi\pi$ phase motion from GARCIA-MARTIN 07 and σ -poles from GARCIA-MARTIN 07 and CAPRINI 06.

NODE=M014W2;LINKAGE=BE

61 Using twice-subtracted dispersion integrals.

NODE=M014W2;LINKAGE=OL

62 Supersedes OLLER 08.

NODE=M014W2;LINKAGE=LL

63 Solution A (preferred solution based on χ^2 -analysis).

NODE=M014W2;LINKAGE=P1

64 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

NODE=M014W2;LINKAGE=P3

65 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

NODE=M014W2;LINKAGE=P2

66 Using unitarity and the σ pole position from CAPRINI 06.

NODE=M014W2;LINKAGE=PE

67 This width could equally well be assigned to the $f_0(1370)$. The authors analyse data from BOYER 90 and MARSISKE 90 and report strong correlation with $\gamma\gamma$ width of $f_2(1270)$.

NODE=M014W2;LINKAGE=A

68 Supersedes MORGAN 90.

NODE=M014W2;LINKAGE=BL

 $f_0(500)$ REFERENCES

NODE=M014

DANILKIN 21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen (MAINZ)
SARANTSEV 21	PL B816 136227	A.V. Sarantsev <i>et al.</i> (BONN, PNPI)
ABLIKIM 17	PRL 118 012001	M. Ablikim <i>et al.</i> (BESIII Collab.)
DAI 14A	PR D90 036004	L.-Y. Dai, M.R. Pennington (CEBAF)
ALBALADEJO 12	PR D86 034003	M. Albaladejo, J.A. Oller (MURC)
GARCIA-MAR... 11	PRL 107 072001	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
GARCIA-MAR... 11A	PR D83 074004	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
HOFERICH... 11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat (BONN+)
MENNESSIER 11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang
MOUSSALLAM 11	EPJ C71 1814	B. Moussallam
BATLEY 10	PL B686 101	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BATLEY 10C	EPJ C70 635	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
MENNESSIER 10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang
MAO 09	PR D79 116008	Y. Mao <i>et al.</i>
BATLEY 08A	EPJ C54 411	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BERNABEU 08	PRL 100 241804	J. Bernabeu, J. Prades (IFIC, GRAN)
CAPRINI 08	PR D77 114019	I. Caprini
MENNESSIER 08	PL B665 205	G. Mennessier, S. Narison, W. Ochs
OLLER 08	PL B659 201	J.A. Oller, L. Roca, C. Schat (MURC, UBA)
OLLER 08A	EPJ A37 15	J.A. Oller, L. Roca (MURC)
PENNINGTON 08	EPJ C56 1	M.R. Pennington <i>et al.</i>

REFID=62088

REFID=61091

REFID=57650

REFID=55923

REFID=54277

REFID=16761

REFID=54121

REFID=53966

REFID=53637

REFID=53975

REFID=53285

REFID=53567

REFID=53657

REFID=52992

REFID=52487

REFID=52271

REFID=52273

REFID=52299

REFID=53976

REFID=53977

REFID=52303

UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
ABLIKIM	07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51614
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>		REFID=53252
GARCIA-MAR...	07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain		REFID=51949
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ANISOVICH	06	IJMP A21 3615	V.V. Anisovich		REFID=51137
CAPRINI	06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)	REFID=51076
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
PENNINGTON	06	PRL 97 011601	M.R. Pennington		REFID=51184
ZHOU	05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>		REFID=50823
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
BUETTIKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam		REFID=56428; ERROR=-1
GALLEGOS	04	PR D69 074033	A. Gallegos <i>et al.</i>		REFID=49769
BUGG	03	PL B572 1	D.V. Bugg		REFID=49586
PISLAK	03	PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PR D81 119903E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53337
MURAMATSU	02	PRL 89 251802	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49081
Also		PRL 90 059901 (err.)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49385
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
BLACK	01	PR D64 014031	D. Black <i>et al.</i>		REFID=48314
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leutwyler		REFID=49180
ISHIDA	01	PL B518 47	M. Ishida <i>et al.</i>		REFID=48354
KOMADA	01	PL B508 31	T. Komada <i>et al.</i>		REFID=48541
PISLAK	01	PRL 87 221801	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=48433
Also		PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PRL 105 019901E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53338
SUROVTSEV	01	PR D63 054024	Y.S. Surovtsev, D. Krupa, M. Nagy		REFID=48310
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BAI	00E	PR D62 032002	J. Bai <i>et al.</i>	(BES Collab.)	REFID=47955
ISHIDA	00B	PTP 104 203	M. Ishida <i>et al.</i>		REFID=48358
ALEKSEEV	99	NP B541 3	I.G. Alekseev <i>et al.</i>		REFID=46614
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
HANNAH	99	PR D60 017502	T. Hannah		REFID=46935
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (err.)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (err.)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ALEKSEEV	98	PAN 61 174	I.G. Alekseev <i>et al.</i>		REFID=46328
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	JINRRC 5-91 33	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PR D56 3057	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PTP 98 1005	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45998
KAMINSKI	97B	PL B413 130	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, IPN)	REFID=45778
Also		PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
SVEC	96	PR D53 2343	M. Svec	(MCGI)	REFID=44509
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELSE)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
ACHASOV	94	PR D49 5779	N.N. Achasov, G.N. Shestakov	(NOVM)	REFID=44087
AMSLER	94D	PL B333 277	C. Amstler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
ZOU	93	PR D48 3948	B.S. Zou, D.V. Bugg	(LOQM)	REFID=43672
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
COURAU	86	NP B271 1	A. Courau <i>et al.</i>	(CLER, LALO)	REFID=44510
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)	REFID=45769
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BISWAS	81	PRL 47 1378	N.N. Biswas <i>et al.</i>	(NDAM, ANL)	REFID=21106
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
MUKHIN	80	JETPL 32 601	K.N. Mukhin <i>et al.</i>	(KIAE)	REFID=44528
		Translated from ZETFP 32 616.			
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
APEL	72C	PL 41B 542	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=21013
BAILLON	72	PL 38B 555	P.H. Baillon <i>et al.</i>	(SLAC)	REFID=20093
BASDEVANT	72	PL 41B 178	J.L. Basdevant, C.D. Froggatt, J.L. Petersen	(CERN)	REFID=20095
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BENSINGER	71	PL 36B 134	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=21006
COLTON	71	PR D3 2028	E.P. Colton <i>et al.</i>	(LBL, FNAL, UCLA+)	REFID=44533
ROY	71	PL 36B 353	S.M. Roy		REFID=51107
BATON	70	PL 33B 528	J.P. Baton, G. Laurens, J. Reigner	(SACL)	REFID=20086
WALKER	67	RMP 39 695	W.D. Walker	(WISC)	REFID=20960

$\rho(770)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

NODE=M009

 $\rho(770)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(761-765) - i (71-74) OUR ESTIMATE			
$(762.5 \pm 1.7) - i (73.2 \pm 1.1)$	¹ HOFERICH... 24	RVUE	Compilation
$(763.7^{+1.7}_{-1.5}) - i (73.2^{+1.0}_{-1.1})$	² GARCIA-MAR..11	RVUE	Compilation
$(754 \pm 18) - i (74 \pm 10)$	³ PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$
$(762.4 \pm 1.8) - i (72.6 \pm 1.4)$	COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$

¹ Update of GARCIA-MARTIN 11 with input for $\pi\pi$ T-matrix from HOFERICHTER 16.
² Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73 using GKPY equations.
³ Reanalysis of data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.

NODE=M009PP

NODE=M009PP

NODE=M009PP

→ UNCHECKED ←

OCCUR=2

OCCUR=2

NODE=M009PP;LINKAGE=D

NODE=M009PP;LINKAGE=C

NODE=M009PP;LINKAGE=B

 $\rho(770)$ MASS

We no longer list S-wave Breit-Wigner fits, or data with high combinatorial background.

NODE=M009205

NODE=M009205

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26±0.23 OUR AVERAGE				
$775.3 \pm 0.5 \pm 0.6$		¹ ACHASOV 21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
775.02 ± 0.35		² LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$775.97 \pm 0.46 \pm 0.70$	900k	³ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
$774.6 \pm 0.4 \pm 0.5$	800k	^{4,5} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
$775.65 \pm 0.64 \pm 0.50$	114k	^{6,7} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
$775.9 \pm 0.5 \pm 0.5$	1.98M	⁸ ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$775.8 \pm 0.9 \pm 2.0$	500k	⁸ ACHASOV 02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 ± 1.1		⁹ BARKOV 85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
775.4 ± 0.1	34M	¹⁰ IGNATOV 24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
763.49 ± 0.53		¹¹ BARTOS 17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
758.23 ± 0.46		¹² BARTOS 17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
$775.8 \pm 0.5 \pm 0.3$	1.98M	¹³ ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$775.9 \pm 0.6 \pm 0.5$	1.98M	¹⁴ ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$775.0 \pm 0.6 \pm 1.1$	500k	¹⁵ ACHASOV 02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$775.1 \pm 0.7 \pm 5.3$		¹⁶ BENAYOUN 98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
$770.5 \pm 1.9 \pm 5.1$		¹⁷ GARDNER 98	RVUE	$0.28-0.92 e^+e^- \rightarrow \pi^+\pi^-$
764.1 ± 0.7		¹⁸ O'CONNELL 97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
757.5 ± 1.5		¹⁹ BERNICHA 94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
768 ± 1		²⁰ GESHKEN... 89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

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NODE=M009M0

OCCUR=2

OCCUR=3

OCCUR=3

NODE=M009M0;LINKAGE=D

NODE=M009M0;LINKAGE=LE

NODE=M009M0;LINKAGE=AK

NODE=M009M0;LINKAGE=AC

NODE=M009M0;LINKAGE=SN

NODE=M009M0;LINKAGE=GS

NODE=M009M0;LINKAGE=PT

NODE=M009M0;LINKAGE=CH

NODE=M009M0;LINKAGE=K

NODE=M009M0;LINKAGE=E

¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.

² Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

³ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

⁴ Supersedes ACHASOV 05A.

⁵ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

⁶ Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference.

⁷ Update of AKHMETSHIN 02.

⁸ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁹ From the GOUNARIS 68 parametrization of the pion form factor.

¹⁰ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference with ω and ϕ masses and widths constrained by the values and their errors from PDG 22, and leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.

- 11 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.
- 12 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.
- 13 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- 14 Without limitations on masses and widths.
- 15 Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- 16 Using the data of BARKOV 85 in the hidden local symmetry model.
- 17 From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
- 18 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- 19 Applying the S-matrix formalism to the BARKOV 85 data.
- 20 Includes BARKOV 85 data. Model-dependent width definition.

NODE=M009M0;LINKAGE=A

NODE=M009M0;LINKAGE=B

NODE=M009M0;LINKAGE=DF
NODE=M009M0;LINKAGE=WONODE=M009M0;LINKAGE=HC
NODE=M009M0;LINKAGE=K2
NODE=M009M0;LINKAGE=G8NODE=M009M0;LINKAGE=AB
NODE=M009M0;LINKAGE=AA
NODE=M009M0;LINKAGE=F**CHARGED ONLY, τ DECAYS and e^+e^-**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
775.11±0.34 OUR AVERAGE					
774.6 ±0.2 ±0.5	5.4M	1,2 FUJIKAWA	08	BELL ±	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 ±0.7		2,3 SCHAEEL	05c	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 ±0.5 ±0.4	1.98M	4 ALOISIO	03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ±1.1 ±0.5	87k	5,6 ANDERSON	00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
761.60±0.95		7 BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.8 ±0.6 ±0.4	1.98M	8 ALOISIO	03	KLOE -	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
776.3 ±0.6 ±0.7	1.98M	8 ALOISIO	03	KLOE +	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
773.9 ±2.0 $\begin{smallmatrix} +0.3 \\ -1.0 \end{smallmatrix}$		9 SANZ-CILLERO	03	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.5 ±0.7 ±1.5	500k	4 ACHASOV	02	SND ±	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ±0.5		10 PICH	01	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

NODE=M009M5
NODE=M009M5

OCCUR=2

OCCUR=3

OCCUR=2

1 $|F_\pi(0)|^2$ fixed to 1.

2 From the GOUNARIS 68 parametrization of the pion form factor.

3 The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.

4 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.5 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

6 From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.

7 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of FUJIKAWA 08.

8 Without limitations on masses and widths.

9 Using the data of BARATE 97M and the effective chiral Lagrangian.

10 From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.

NODE=M009M5;LINKAGE=FU
NODE=M009M5;LINKAGE=GO
NODE=M009M5;LINKAGE=SC
NODE=M009M5;LINKAGE=CH
NODE=M009M5;LINKAGE=A6
NODE=M009M5;LINKAGE=K1

NODE=M009M5;LINKAGE=A

NODE=M009M5;LINKAGE=WO
NODE=M009M5;LINKAGE=Z
NODE=M009M5;LINKAGE=PC**MIXED CHARGES, OTHER REACTIONS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
763.0±0.3±1.2	600k	1 ABELE	99E	CBAR 0±	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

1 Assuming the equality of ρ^+ and ρ^- masses and widths.NODE=M009M7
NODE=M009M7

NODE=M009M7;LINKAGE=LB

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
766.5±1.1 OUR AVERAGE					
763.7±3.2		ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^- \pi^0 \pi^0$
768 ±9		AGUILAR-...	91	EHS	400 $p\bar{p}$
767 ±3	2935	1 CAPRARO	87	SPEC -	$200 \pi^- \text{Cu} \rightarrow \pi^- \pi^0 \text{Cu}$
761 ±5	967	1 CAPRARO	87	SPEC -	$200 \pi^- \text{Pb} \rightarrow \pi^- \pi^0 \text{Pb}$
771 ±4		HUSTON	86	SPEC +	$202 \pi^+ \text{A} \rightarrow \pi^+ \pi^0 \text{A}$
766 ±7	6500	2 BYERLY	73	OSPK -	$5 \pi^- p$
766.8±1.5	9650	3 PISUT	68	RVUE -	$1.7-3.2 \pi^- p, t < 10$
767 ±6	900	1 EISNER	67	HBC -	$4.2 \pi^- p, t < 10$

NODE=M009M2
NODE=M009M2

OCCUR=2

1 Mass errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass.

2 Phase shift analysis. Systematic errors added corresponding to spread of different fits.

3 From fit of 3-parameter relativistic P -wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.NODE=M009M2;LINKAGE=Z
NODE=M009M2;LINKAGE=X
NODE=M009M2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
769.2 ± 0.9 OUR AVERAGE				
770.8 ± 1.3 ^{+2.3} _{-2.4}	900k	ANDREEV 20	H1	$ep \rightarrow e\pi^+\pi^-p$
771 ± 2 ⁺² ₋₁	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
770 ± 2 ± 1	79k	² BREITWEG 98B	ZEUS	50-100 γp
767.6 ± 2.7		BARTALUCCI 78	CNTR	$\gamma p \rightarrow e^+e^-p$
775 ± 5		GLADDING 73	CNTR	2.9-4.7 γp
767 ± 4	1930	BALLAM 72	HBC	2.8 γp
770 ± 4	2430	BALLAM 72	HBC	4.7 γp
765 ± 10		ALVENSLEB... 70	CNTR	$\gamma A, t < 0.01$
767.7 ± 1.9	140k	BIGGS 70	CNTR	$< 4.1 \gamma C \rightarrow \pi^+\pi^-C$
765 ± 5	4000	ASBURY 67B	CNTR	$\gamma + Pb$

• • • We do not use the following data for averages, fits, limits, etc. • • •

771 ± 2	79k	³ BREITWEG 98B	ZEUS	50-100 γp
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¹ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.
² From the parametrization according to SOEDING 66.
³ From the parametrization according to ROSS 66.

NODE=M009M0P
 NODE=M009M0P

OCCUR=2

OCCUR=2

NODE=M009M0P;LINKAGE=AB
 NODE=M009M0P;LINKAGE=B5
 NODE=M009M0P;LINKAGE=B6

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
769.0 ± 0.9 OUR AVERAGE				Error includes scale factor of 1.4. See the ideogram below.
765 ± 6		BERTIN 97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
773 ± 1.6		WEIDENAUER 93	ASTE	$\bar{p}p \rightarrow \pi^+\pi^-\omega$
762.6 ± 2.6		AGUILAR-... 91	EHS	400 pp
770 ± 2		¹ HEYN 81	RVUE	Pion form factor
768 ± 4		^{2,3} BOHACIK 80	RVUE	
769 ± 3		⁴ WICKLUND 78	ASPK	3,4,6 $\pi^\pm N$
768 ± 1	76k	DEUTSCH... 76	HBC	16 π^+p
767 ± 4	4100	ENGLER 74	DBC	6 $\pi^+n \rightarrow \pi^+\pi^-p$
775 ± 4	32k	² PROTOPOP... 73	HBC	7.1 $\pi^+p, t < 0.4$
764 ± 3	6.8k	⁵ RATCLIFF 72	ASPK	15 $\pi^-p, t < 0.3$
774 ± 3	1.7k	REYNOLDS 69	HBC	2.26 π^-p
769.2 ± 1.5	13.3k	⁶ PISUT 68	RVUE	1.7-3.2 $\pi^-p, t < 10$

• • • We do not use the following data for averages, fits, limits, etc. • • •

774.34 ± 0.18 ± 0.35	970k	⁷ ABLIKIM 18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
772.93 ± 0.18 ± 0.34	970k	⁸ ABLIKIM 18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
773.5 ± 2.5		⁹ COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$
762.3 ± 0.5 ± 1.2	600k	¹⁰ ABELE 99E	CBAR	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
777 ± 2	4.9k	¹¹ ADAMS 97	E665	470 $\mu p \rightarrow \mu XB$
770 ± 2		¹² BOGOLYUB... 97	MIRA	32 $\bar{p}p \rightarrow \pi^+\pi^-X$
768 ± 8		¹² BOGOLYUB... 97	MIRA	32 $pp \rightarrow \pi^+\pi^-X$
761.1 ± 2.9		DUBNICKA 89	RVUE	π form factor
777.4 ± 2.0		¹³ CHABAUD 83	ASPK	17 π^-p polarized
769.5 ± 0.7		^{2,3} LANG 79	RVUE	
770 ± 9		³ ESTABROOKS 74	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
773.5 ± 1.7	11.2k	¹⁴ JACOBS 72	HBC	2.8 π^-p
775 ± 3	2.2k	¹⁵ HYAMS 68	OSPK	11.2 π^-p

¹ HEYN 81 includes all spacelike and timelike F_π values until 1978.

² From pole extrapolation.

³ From phase shift analysis of GRAYER 74 data.

⁴ Phase shift analysis. Systematic errors added corresponding to spread of different fits.

⁵ Published values contain misprints. Corrected by private communication RATCLIFF 74.

⁶ Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDBERGER 64, ABOLINS 63.

⁷ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.

⁸ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.

⁹ Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.

¹⁰ Using relativistic Breit-Wigner and taking into account ρ - ω interference.

¹¹ Systematic errors not evaluated.

¹² Systematic effects not studied.

¹³ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P-wave intensity. CHABAUD 83 includes data of GRAYER 74.

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 NODE=M009M0R

OCCUR=2

OCCUR=2

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 NODE=M009M0R;LINKAGE=C0
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 NODE=M009M0R;LINKAGE=X
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 NODE=M009M0R;LINKAGE=R

NODE=M009M0R;LINKAGE=B

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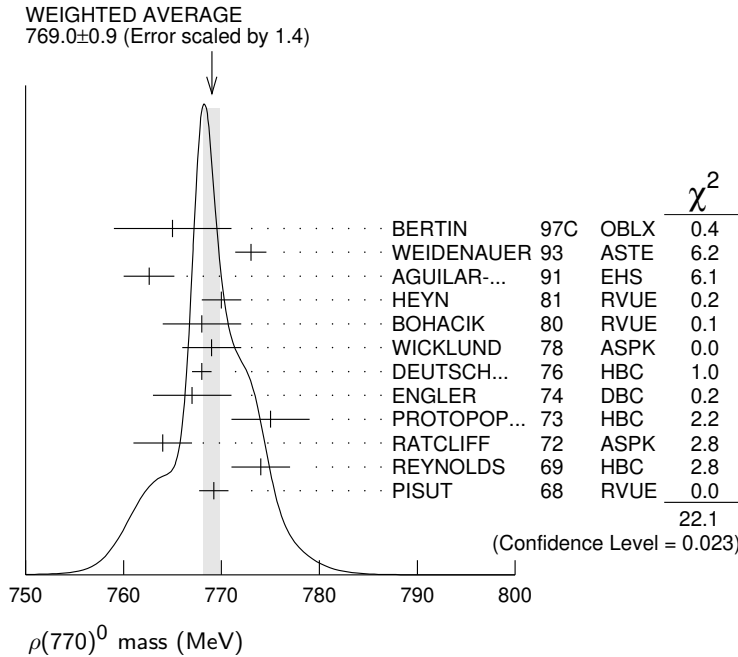
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NODE=M009M0R;LINKAGE=BL
 NODE=M009M0R;LINKAGE=A1
 NODE=M009M0R;LINKAGE=QQ
 NODE=M009M0R;LINKAGE=G

¹⁴ Mass errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass.

¹⁵ Of HYAMS 68 six parametrizations, this is theoretically soundest. MR

NODE=M009M0R;LINKAGE=Z
 NODE=M009M0R;LINKAGE=02



$m_{\rho(770)^0} - m_{\rho(770)^\pm}$

NODE=M009D

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT	
-0.7 ± 0.8	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.				
-2.4 ± 0.8	1	SCHAEL	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	
0.4 ± 0.7 ± 0.6	1.98M	2	ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3 ± 1.1 ± 2.0	500k	2	ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.6 ± 0.6 ± 1.7	600k		ABELE	99E	CBAR ± 0	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 ± 4	3000	3	REYNOLDS	69	HBC	-0 2.26 $\pi^- \rho$
-5 ± 5	3600	3	FOSTER	68	HBC	± 0 0.0 $\bar{p} p$
2.4 ± 2.1	22950	4	PISUT	68	RVUE	$\pi N \rightarrow \rho N$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
-3.37 ± 1.06	5	BARTOS	17A	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$, $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$	

NODE=M009D

¹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAEL 05c and $e^+ e^-$ data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

NODE=M009D;LINKAGE=SC

² Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

NODE=M009D;LINKAGE=CH

³ From quoted masses of charged and neutral modes.

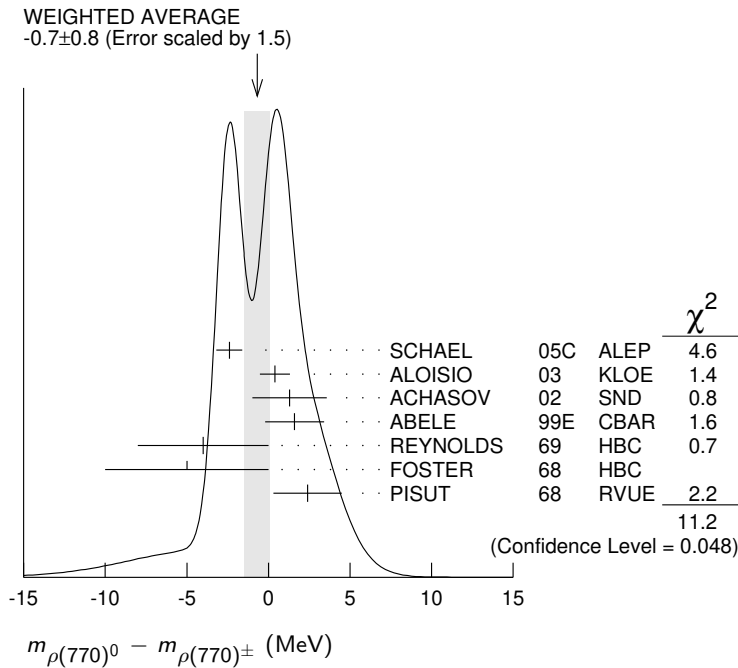
NODE=M009D;LINKAGE=A

⁴ Includes MALAMUD 69, ARMENISE 68, BATON 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65, CARMONY 64, GOLDHABER 64, ABOLINS 63.

NODE=M009D;LINKAGE=R

⁵ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M009D;LINKAGE=B



$m_{\rho(770)^+} - m_{\rho(770)^-}$

NODE=M009D1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M009D1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.5 \pm 0.8 \pm 0.7$	1.98M	¹ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
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NODE=M009D;LINKAGE=WO

¹Without limitations on masses and widths.

$\rho(770)$ RANGE PARAMETER

NODE=M009R

The range parameter R enters an energy-dependent correction to the width, of the form $(1 + q_r^2 R^2) / (1 + q^2 R^2)$, where q is the momentum of one of the pions in the $\pi\pi$ rest system. At resonance, $q = q_r$.

NODE=M009R

VALUE (GeV^{-1})	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M009R

$5.3^{+0.9}_{-0.7}$	¹ CHABAUD	83 ASPK	0	$17 \pi^- p$ polarized
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¹The old PISUT 68 value, properly corrected, was 3.2 ± 0.6 .

NODE=M009R;LINKAGE=01

$\rho(770)$ WIDTH

NODE=M009220

We no longer list S -wave Breit-Wigner fits, or data with high combinatorial background.

NODE=M009220

NEUTRAL ONLY, $e^+ e^-$

NODE=M009W0

NODE=M009W0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
147.4 ± 0.8				OUR AVERAGE
Error includes scale factor of 2.0. See the ideogram below.				
$145.6 \pm 0.6 \pm 0.8$		¹ ACHASOV	21 SND	$e^+ e^- \rightarrow \pi^+ \pi^-$
149.59 ± 0.67		² LEES	12G BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$145.98 \pm 0.75 \pm 0.50$	900k	³ AKHMETSHIN	07	$e^+ e^- \rightarrow \pi^+ \pi^-$
$146.1 \pm 0.8 \pm 1.5$	800k	^{4,5} ACHASOV	06 SND	$e^+ e^- \rightarrow \pi^+ \pi^-$
$143.85 \pm 1.33 \pm 0.80$	114k	^{6,7} AKHMETSHIN	04 CMD2	$e^+ e^- \rightarrow \pi^+ \pi^-$
$147.3 \pm 1.5 \pm 0.7$	1.98M	⁸ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$151.1 \pm 2.6 \pm 3.0$	500k	⁸ ACHASOV	02 SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.5 ± 3.0		⁹ BARKOV	85 OLYA	$e^+ e^- \rightarrow \pi^+ \pi^-$

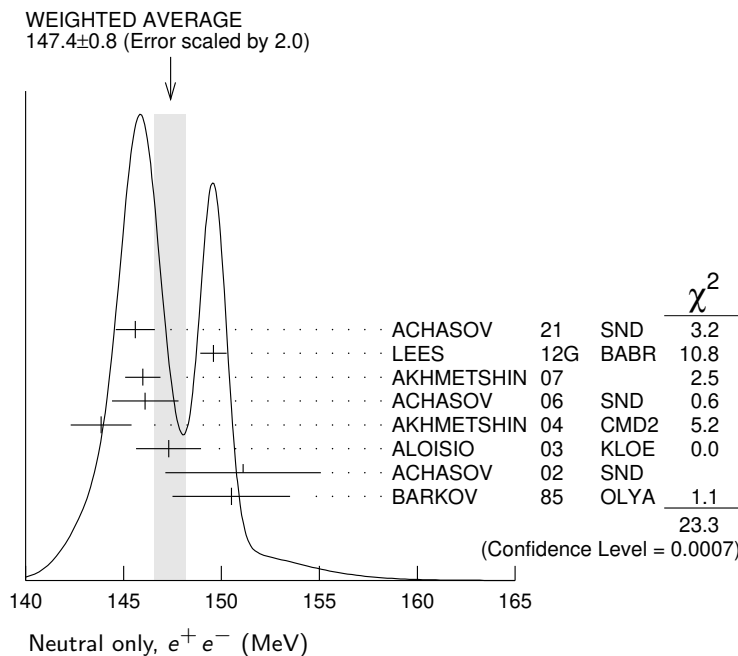
••• We do not use the following data for averages, fits, limits, etc. •••

148.76±0.17	34M	10	IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
144.06±0.85		11	BARTOS	17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
144.56±0.80		12	BARTOS	17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
143.9 ±1.3 ±1.1	1.98M	13	ALOISIO	03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^0$
147.4 ±1.5 ±0.7	1.98M	14	ALOISIO	03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^0$
149.8 ±2.2 ±2.0	500k	15	ACHASOV	02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^0$
147.9 ±1.5 ±7.5		16	BENAYOUN	98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
153.5 ±1.3 ±4.6		17	GARDNER	98	RVUE	$0.28-0.92 e^+e^- \rightarrow \pi^+\pi^-$
145.0 ±1.7		18	O'CONNELL	97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
142.5 ±3.5		19	BERNICA	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
138 ±1		20	GESHKEN...	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

OCCUR=2
OCCUR=3
OCCUR=3

- 1 From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.
- 2 Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
- 3 A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- 4 Supersedes ACHASOV 05A.
- 5 A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.
- 6 Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference.
- 7 From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.
- 8 Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- 9 From the GOUNARIS 68 parametrization of the pion form factor.
- 10 From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference with ω and ϕ masses and widths constrained by the values and their errors from PDG 22, and leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.
- 11 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.
- 12 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.
- 13 Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.
- 14 Without limitations on masses and widths.
- 15 Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
- 16 Using the data of BARKOV 85 in the hidden local symmetry model.
- 17 From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
- 18 A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
- 19 Applying the S-matrix formalism to the BARKOV 85 data.
- 20 Includes BARKOV 85 data. Model-dependent width definition.

NODE=M009W0;LINKAGE=D
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NODE=M009W;LINKAGE=AK
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NODE=M009W;LINKAGE=WO
NODE=M009W;LINKAGE=HC
NODE=M009W;LINKAGE=K2
NODE=M009W;LINKAGE=G8
NODE=M009W;LINKAGE=AB
NODE=M009W;LINKAGE=AA
NODE=M009W;LINKAGE=F



CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
149.1 ± 0.8 OUR FIT					
149.1 ± 0.8 OUR AVERAGE					
148.1 ± 0.4	± 1.7	5.4M	1,2 FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0 ± 1.2			2,3 SCHAEL	05c ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9 ± 2.3	± 2.0	500k	4 ACHASOV	02 SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.4 ± 1.4	± 1.4	87k	5,6 ANDERSON	00A CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
139.90 ± 0.46			7 BARTOS	17A RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
143.7 ± 1.3	± 1.2	1.98M	4 ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
142.9 ± 1.3	± 1.4	1.98M	8 ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
144.7 ± 1.4	± 1.2	1.98M	8 ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.2 ± 2.0	$+0.7$ -1.6		9 SANZ-CILLERO	03 RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
150.9 ± 2.2	± 2.0	500k	10 ACHASOV	02 SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W5
 NODE=M009W5

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

¹ $|F_\pi(0)|^2$ fixed to 1.

² From the GOUNARIS 68 parametrization of the pion form factor.

³ The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.

⁴ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁵ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁶ From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.

⁷ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.

⁸ Without limitations on masses and widths.

⁹ Using the data of BARATE 97M and the effective chiral Lagrangian.

¹⁰ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0 \pi \pi} = g_{\rho^\pm \pi \pi}$.

NODE=M009W5;LINKAGE=FU
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 NODE=M009W5;LINKAGE=SC

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 NODE=M009W5;LINKAGE=K1

NODE=M009W5;LINKAGE=A

NODE=M009W5;LINKAGE=W0
 NODE=M009W5;LINKAGE=Z

NODE=M009W5;LINKAGE=HC

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
149.5 ± 1.3	600k	¹ ABELE	99E CBAR	0 \pm	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$

¹ Assuming the equality of ρ^+ and ρ^- masses and widths.

NODE=M009W7
 NODE=M009W7

NODE=M009W;LINKAGE=LB

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150.2 ± 2.4 OUR FIT					
150.2 ± 2.4 OUR AVERAGE					
152.8 ± 4.3			ABELE	97 CBAR	$\bar{p} n \rightarrow \pi^- \pi^0 \pi^0$
155 ± 11	2.9k	¹ CAPRARO	87 SPEC	-	200 $\pi^- \text{Cu} \rightarrow \pi^- \pi^0 \text{Cu}$
154 ± 20	967	¹ CAPRARO	87 SPEC	-	200 $\pi^- \text{Pb} \rightarrow \pi^- \pi^0 \text{Pb}$
150 ± 5		HUSTON	86 SPEC	+	202 $\pi^+ \text{A} \rightarrow \pi^+ \pi^0 \text{A}$
146 ± 12	6.5k	² BYERLY	73 OSPK	-	5 $\pi^- p$
148.2 ± 4.1	9.6k	³ PISUT	68 RVUE	-	1.7-3.2 $\pi^- p$, $t < 10$
146 ± 13	900	EISNER	67 HBC	-	4.2 $\pi^- p$, $t < 10$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

137.0 ± 0.4 ⁴ ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma 3\pi$

¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

² Phase shift analysis. Systematic errors added corresponding to spread of different fits.

³ From fit of 3-parameter relativistic P -wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.

⁴ S-matrix pole at a fixed ρ meson mass of 775.49 MeV.

NODE=M009W2
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OCCUR=2

NODE=M009W2;LINKAGE=Z
 NODE=M009W2;LINKAGE=X
 NODE=M009W2;LINKAGE=A1

NODE=M009W2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.5 $^{+1.9}_{-2.1}$ OUR AVERAGE				
151.3 ± 2.2	$^{+1.6}_{-2.8}$	900k	ANDREEV	20 H1 $ep \rightarrow e\pi^+\pi^-p$
155 ± 5	± 2	63.5k	¹ ABRAMOWICZ	12 ZEUS $ep \rightarrow e\pi^+\pi^-p$
146 ± 3	± 13	79k	² BREITWEG	98B ZEUS 50-100 γp
150.9 ± 3.0			BARTALUCCI	78 CNTR $\gamma p \rightarrow e^+ e^- p$

NODE=M009W0P
 NODE=M009W0P

• • • We do not use the following data for averages, fits, limits, etc. • • •

138 ± 3	79k	³ BREITWEG	98B	ZEUS	50–100 γp	OCCUR=2
147 ± 11		GLADDING	73	CNTR	2.9–4.7 γp	
155 ± 12	2430	BALLAM	72	HBC	4.7 γp	
145 ± 13	1930	BALLAM	72	HBC	2.8 γp	OCCUR=2
140 ± 5		ALVENSLEB...	70	CNTR	γA , $t < 0.01$	
146.1 ± 2.9	140k	BIGGS	70	CNTR	$< 4.1 \gamma C \rightarrow \pi^+ \pi^- C$	
160 ± 10		LANZEROTTI	68	CNTR	γp	
130 ± 5	4000	ASBURY	67B	CNTR	$\gamma + Pb$	

¹ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.

² From the parametrization according to SOEDING 66.

³ From the parametrization according to ROSS 66.

NODE=M009W0P;LINKAGE=AB

NODE=M009W;LINKAGE=B5

NODE=M009W;LINKAGE=B6

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
150.9 ± 1.7 OUR AVERAGE		Error includes scale factor of 1.1.		
122 ± 20		BERTIN	97C	OBLX 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
145.7 ± 5.3		WEIDENAUER	93	ASTE $\bar{p}p \rightarrow \pi^+ \pi^- \omega$
144.9 ± 3.7		DUBNICKA	89	RVUE π form factor
148 ± 6		^{1,2} BOHACIK	80	RVUE
152 ± 9		³ WICKLUND	78	ASPK 3,4,6 $\pi^\pm pN$
154 ± 2	76k	DEUTSCH...	76	HBC 16 $\pi^+ p$
157 ± 8	6.8k	⁴ RATCLIFF	72	ASPK 15 $\pi^- p$, $t < 0.3$
143 ± 8	1.7k	REYNOLDS	69	HBC 2.26 $\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

150.85 ± 0.55 ± 0.67	970k	⁵ ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma \pi^+ \pi^-$	
150.18 ± 0.55 ± 0.65	970k	⁶ ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma \pi^+ \pi^-$	OCCUR=2
147.0 ± 2.5	600k	⁷ ABELE	99E	CBAR 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	
146 ± 3	4.9k	⁸ ADAMS	97	E665 470 $\mu p \rightarrow \mu XB$	
160.0 + 4.1 - 4.0		⁹ CHABAUD	83	ASPK 17 $\pi^- p$ polarized	
155 ± 1		¹⁰ HEYN	81	RVUE π form factor	
148.0 ± 1.3		^{1,2} LANG	79	RVUE	
146 ± 14	4.1k	ENGLER	74	DBC 6 $\pi^+ n \rightarrow \pi^+ \pi^- p$	
143 ± 13		² ESTABROOKS	74	RVUE 17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
160 ± 10	32k	¹ PROTOPOP...	73	HBC 7.1 $\pi^+ p$, $t < 0.4$	
145 ± 12	2.2k	^{3,11} HYAMS	68	OSPK 11.2 $\pi^- p$	
163 ± 15	13.3k	¹² PISUT	68	RVUE 1.7–3.2 $\pi^- p$, $t < 10$	

¹ From pole extrapolation.

² From phase shift analysis of GRAYER 74 data.

³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁴ Published values contain misprints. Corrected by private communication RATCLIFF 74.

⁵ From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.

⁶ From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.

⁷ Using relativistic Breit-Wigner and taking into account ρ - ω interference.

⁸ Systematic errors not evaluated.

⁹ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.

¹⁰ HEYN 81 includes all spacelike and timelike F_π values until 1978.

¹¹ Of HYAMS 68 six parametrizations this is theoretically soundest. MR

¹² Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDHABER 64, ABOLINS 63.

NODE=M009W;LINKAGE=C

NODE=M009W;LINKAGE=H

NODE=M009W;LINKAGE=Z

NODE=M009W;LINKAGE=03

NODE=M009W0R;LINKAGE=B

NODE=M009W0R;LINKAGE=C

NODE=M009W;LINKAGE=BL

NODE=M009W;LINKAGE=A1

NODE=M009W;LINKAGE=G

NODE=M009W;LINKAGE=B

NODE=M009W;LINKAGE=02

NODE=M009W;LINKAGE=R

$\Gamma_{\rho(770)^0} - \Gamma_{\rho(770)^\pm}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.3 ± 1.3 OUR AVERAGE		Error includes scale factor of 1.4.		
-0.2 ± 1.0		¹ SCHAEEL	05C	ALEP $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
3.6 ± 1.8 ± 1.7	1.98M	² ALOISIO	03	KLOE 1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.66 ± 0.85		³ BARTOS	17A	RVUE $e^+ e^- \rightarrow \pi^+ \pi^-, \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
-------------	--	---------------------	-----	---

NODE=M009W6

NODE=M009W6

¹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAELE 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

² Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

$$\Gamma_{\rho(770)^+} = \Gamma_{\rho(770)^-}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±2.0±0.5	1.98M	¹ ALOISIO	03	KLOE 1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ Without limitations on masses and widths.

NODE=M009W6;LINKAGE=SC

NODE=M009W6;LINKAGE=CH
NODE=M009W6;LINKAGE=A

NODE=M009W16
NODE=M009W16

NODE=M009W16;LINKAGE=WO

NODE=M009225;NODE=M009

$\rho(770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\pi\pi$	~ 100	%
$\rho(770)^\pm$ decays		
Γ_2 $\pi^\pm\pi^0$	~ 100	%
Γ_3 $\pi^\pm\gamma$	(4.5 ± 0.5)	$\times 10^{-4}$ S=2.2
Γ_4 $\pi^\pm\eta$	< 6	$\times 10^{-3}$ CL=84%
Γ_5 $\pi^\pm\pi^+\pi^-\pi^0$	< 2.0	$\times 10^{-3}$ CL=84%
$\rho(770)^0$ decays		
Γ_6 $\pi^+\pi^-$	~ 100	%
Γ_7 $\pi^+\pi^-\gamma$	(9.9 ± 1.6)	$\times 10^{-3}$
Γ_8 $\pi^0\gamma$	(4.7 ± 0.8)	$\times 10^{-4}$ S=1.7
Γ_9 $\eta\gamma$	(3.00±0.21)	$\times 10^{-4}$
Γ_{10} $\pi^0\pi^0\gamma$	(4.5 ± 0.8)	$\times 10^{-5}$
Γ_{11} $\mu^+\mu^-$	[a] (4.55±0.28)	$\times 10^{-5}$
Γ_{12} e^+e^-	[a] (4.72±0.05)	$\times 10^{-5}$
Γ_{13} $\pi^+\pi^-\pi^0$	(1.01 ^{+0.54} _{-0.36} ±0.34)	$\times 10^{-4}$
Γ_{14} $\pi^+\pi^-\pi^+\pi^-$	(1.8 ± 0.9)	$\times 10^{-5}$
Γ_{15} $\pi^+\pi^-\pi^0\pi^0$	(1.6 ± 0.8)	$\times 10^{-5}$
Γ_{16} $\pi^0e^+e^-$	< 1.2	$\times 10^{-5}$ CL=90%
Γ_{17} ηe^+e^-		

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M009;CLUMP=A
DESIG=11;OUR EVAL;→ UNCHECKED ←
DESIG=3
DESIG=5
DESIG=21

NODE=M009;CLUMP=B
DESIG=12;OUR EVAL;→ UNCHECKED ←
DESIG=60
DESIG=40
DESIG=8
DESIG=80
DESIG=6
DESIG=4
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=22
DESIG=30
DESIG=9
DESIG=10

[a] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \rightarrow \mu^+\mu^-) = \Gamma(\rho^0 \rightarrow e^+e^-) \times 0.99785$.

LINKAGE=MD2

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 10 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 10.7$ for 8 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_3 \left| \begin{array}{cc} -100 & \\ \hline 15 & -15 \\ \hline x_2 & x_3 \end{array} \right.$$

Mode	Rate (MeV)	Scale factor
Γ_2 $\pi^\pm\pi^0$	150.2 ± 2.4	
Γ_3 $\pi^\pm\gamma$	0.068±0.007	2.3

DESIG=11
DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 21 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 9.5$ for 13 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_7	-100								
x_8	-5	0							
x_9	-1	0	1						
x_{10}	-1	0	0	0					
x_{11}	2	-3	0	0	0				
x_{12}	0	0	-6	-9	0	0			
x_{14}	-1	0	0	0	0	0	0		
Γ	0	0	3	5	0	0	-54	0	
		x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{14}

Mode	Rate (MeV)	Scale factor
Γ_6 $\pi^+ \pi^-$	147.5 \pm 0.9	
Γ_7 $\pi^+ \pi^- \gamma$	1.48 \pm 0.24	
Γ_8 $\pi^0 \gamma$	0.070 \pm 0.012	1.7
Γ_9 $\eta \gamma$	0.0447 \pm 0.0032	
Γ_{10} $\pi^0 \pi^0 \gamma$	0.0066 \pm 0.0012	
Γ_{11} $\mu^+ \mu^-$	[a] 0.0068 \pm 0.0004	
Γ_{12} $e^+ e^-$	[a] 0.00704 \pm 0.00006	
Γ_{14} $\pi^+ \pi^- \pi^+ \pi^-$	0.0027 \pm 0.0014	

DESIG=12
DESIG=60
DESIG=40
DESIG=8
DESIG=80
DESIG=6
DESIG=4
DESIG=22

$\rho(770)$ PARTIAL WIDTHS

NODE=M009230

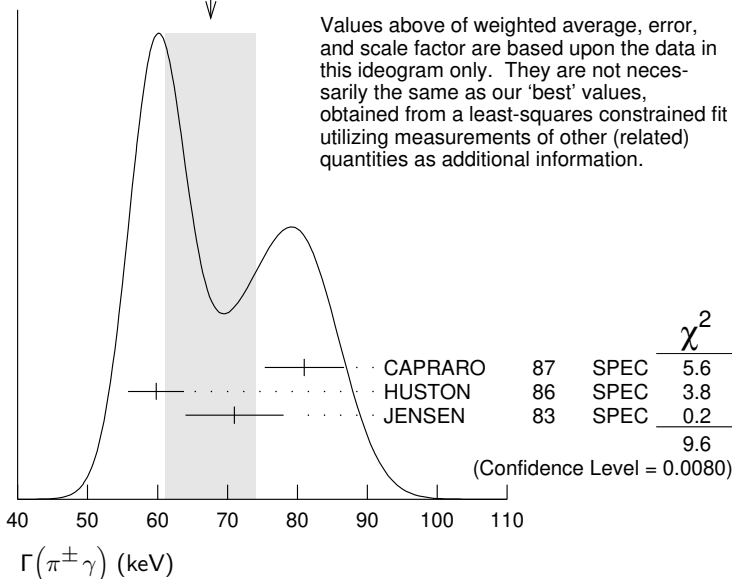
$\Gamma(\pi^\pm \gamma)$

Γ_3

NODE=M009W3
NODE=M009W3

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
68 \pm 7 OUR FIT	Error includes scale factor of 2.3.			
68 \pm 7 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.			
81 \pm 4 \pm 4	CAPRARO	87	SPEC -	200 $\pi^- A \rightarrow \pi^- \pi^0 A$
59.8 \pm 4.0	HUSTON	86	SPEC +	202 $\pi^+ A \rightarrow \pi^+ \pi^0 A$
71 \pm 7	JENSEN	83	SPEC -	156-260 $\pi^- A \rightarrow \pi^- \pi^0 A$

WEIGHTED AVERAGE
68 \pm 7 (Error scaled by 2.2)



$\Gamma(\pi^0\gamma)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

$77 \pm 17 \pm 11$	36500	¹ ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
121 ± 31		DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

¹ Using $\Gamma_{\text{total}} = 147.9 \pm 1.3$ MeV and $B(\rho \rightarrow \pi^0\gamma)$ from ACHASOV 03.

NODE=M009W31
NODE=M009W31

NODE=M009W31;LINKAGE=AV

 $\Gamma(\eta\gamma)$ Γ_9

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

62 ± 17	¹ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$
-------------	--------------------------	----	---------------------------------

¹ Solution corresponding to constructive ω - ρ interference.

NODE=M009W32
NODE=M009W32

NODE=M009W32;LINKAGE=L

 $\Gamma(e^+e^-)$ Γ_{12}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

7.04 ± 0.06 OUR FIT

7.04 ± 0.06 OUR AVERAGE

$7.048 \pm 0.057 \pm 0.050$	900k	¹ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
$7.06 \pm 0.11 \pm 0.05$	114k	^{2,3} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
$6.77 \pm 0.10 \pm 0.30$		BARKOV 85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.12 \pm 0.02 \pm 0.11$	800k	⁴ ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
6.3 ± 0.1		⁵ BENAYOUN 98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$

¹ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

² Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

³ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.

⁴ Supersedes ACHASOV 05A.

⁵ Using the data of BARKOV 85 in the hidden local symmetry model.

NODE=M009W4
NODE=M009W4

OCCUR=2

NODE=M009W4;LINKAGE=AK
NODE=M009W4;LINKAGE=GS
NODE=M009W4;LINKAGE=P2
NODE=M009W4;LINKAGE=AC
NODE=M009W4;LINKAGE=K2

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)$ Γ_{14}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.8 \pm 1.4 \pm 0.5$	153	AKHMETSHIN 00	CMD2	$0.6-0.97 e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
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NODE=M009W33
NODE=M009W33

 $\rho(770) \Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$

NODE=M009233

 $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_6/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

4.89 ± 0.04 OUR AVERAGE

$4.889 \pm 0.015 \pm 0.039$		¹ ACHASOV 21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
$4.876 \pm 0.023 \pm 0.064$	800k	^{2,3} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.72 ± 0.02		⁴ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$
-----------------	--	--------------------------	------	-------------------

¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.

² Supersedes ACHASOV 05A.

³ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G4;LINKAGE=A

NODE=M009G4;LINKAGE=AC
NODE=M009G4;LINKAGE=SN

NODE=M009G4;LINKAGE=BE

 $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

1.42 ± 0.10 OUR FIT

1.45 ± 0.12 OUR AVERAGE

$1.32 \pm 0.14 \pm 0.08$	33k	¹ ACHASOV 07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
$1.50 \pm 0.65 \pm 0.09$	17.4k	² AKHMETSHIN 05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
$1.61 \pm 0.20 \pm 0.11$	23k	^{3,4} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.85 ± 0.49		⁵ DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.05 ± 0.02		⁶ BENAYOUN 10	RVUE	$0.4-1.05 e^+e^-$
-----------------	--	--------------------------	------	-------------------

NODE=M009G1
NODE=M009G1

- ¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
- ² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- ³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- ⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
- ⁵ Recalculated by us from the cross section in the peak.
- ⁶ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G1;LINKAGE=AH

NODE=M009G;LINKAGE=AH
 NODE=M009G;LINKAGE=AK
 NODE=M009G;LINKAGE=BQ

NODE=M009G;LINKAGE=LP
 NODE=M009G1;LINKAGE=BE

$\Gamma(e^+e^-)/\Gamma_{total} \times \Gamma(\pi^0\gamma)/\Gamma_{total}$ $\Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8}) EVTS DOCUMENT ID TECN COMMENT

2.2 ± 0.4 OUR FIT Error includes scale factor of 1.7.

2.21 ± 0.34 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

1.98 ± 0.22 ± 0.10 ¹ ACHASOV 16A SND 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

2.90 ^{+0.60}/_{-0.55} ± 0.18 18k AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

3.61 ± 0.74 ± 0.49 10k ² DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.875 ± 0.026 ³ BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

2.37 ± 0.53 ± 0.33 36k ⁴ ACHASOV 03 SND 0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$

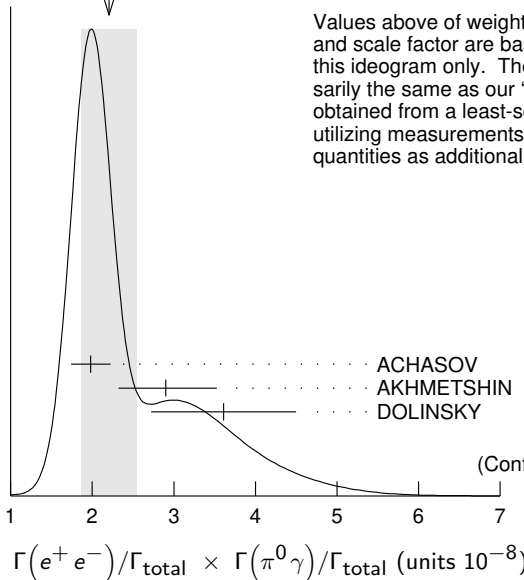
- ¹ From the VMD model with the $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 03.
- ² Recalculated by us from the cross section in the peak.
- ³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.
- ⁴ Using $\sigma_{\phi \rightarrow \pi^0\gamma}$ from ACHASOV 00 and $m_\rho = 775.97$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.

NODE=M009G2;LINKAGE=B

NODE=M009G2;LINKAGE=LP
 NODE=M009G2;LINKAGE=BE

NODE=M009G;LINKAGE=SH

WEIGHTED AVERAGE
 2.21 ± 0.34 (Error scaled by 1.6)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$\Gamma(e^+e^-)/\Gamma_{total} \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ $\Gamma_{12}/\Gamma \times \Gamma_{13}/\Gamma$

VALUE (units 10^{-9}) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.903 ± 0.076 ¹ BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

4.58 ^{+2.46}/_{-1.64} ± 1.56 1.2M ² ACHASOV 03D RVUE 0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

- ¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.
- ² Statistical significance is less than 3σ .

NODE=M009G3
 NODE=M009G3

NODE=M009G3;LINKAGE=BE
 NODE=M009G3;LINKAGE=AC

$\rho(770)$ BRANCHING RATIOS

NODE=M009235

$\Gamma(\pi^\pm\eta)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE (units 10^{-4}) CL% DOCUMENT ID TECN CHG COMMENT

<60 84 FERBEL 66 HBC ± $\pi^\pm p$ above 2.5

NODE=M009R4
 NODE=M009R4

$\Gamma(\pi^\pm \pi^+ \pi^- \pi^0)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<20	84	FERBEL	66	HBC	\pm $\pi^\pm p$ above 2.5
• • • We do not use the following data for averages, fits, limits, etc. • • •					
35 \pm 40		JAMES	66	HBC	+ 2.1 $\pi^+ p$

NODE=M009R1
 NODE=M009R1

 $\Gamma(\pi^+ \pi^- \gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0099\pm0.0016 OUR FIT				
0.0099\pm0.0016		¹ DOLINSKY	91	ND $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0111 \pm 0.0014		² VASSERMAN	88	ND $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
<0.005	90	³ VASSERMAN	88	ND $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

NODE=M009R12
 NODE=M009R12

- ¹ Bremsstrahlung from a decay pion and for photon energy above 50 MeV.
² Superseded by DOLINSKY 91.
³ Structure radiation due to quark rearrangement in the decay.

OCCUR=2

NODE=M009R12;LINKAGE=J
 NODE=M009R12;LINKAGE=I
 NODE=M009R12;LINKAGE=N

 $\Gamma(\pi^0 \gamma)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.20 \pm 0.52		¹ ACHASOV	16A	SND 0.60-1.38 $e^+ e^- \rightarrow \pi^0 \gamma$
6.21 $^{+1.28}_{-1.18}$ \pm 0.39	18k	^{2,3} AKHMETSHIN	05	CMD2 0.60-1.38 $e^+ e^- \rightarrow \pi^0 \gamma$
5.22 \pm 1.17 \pm 0.75	36k	^{3,4} ACHASOV	03	SND 0.60-0.97 $e^+ e^- \rightarrow \pi^0 \gamma$
6.8 \pm 1.7		⁵ BENAYOUN	96	RVUE 0.54-1.04 $e^+ e^- \rightarrow \pi^0 \gamma$
7.9 \pm 2.0		³ DOLINSKY	89	ND $e^+ e^- \rightarrow \pi^0 \gamma$

NODE=M009R9
 NODE=M009R9

- ¹ Using $B(\rho \rightarrow e^+ e^-)$ from PDG 15. Supersedes ACHASOV 03.
² Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$.
³ Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^0 \gamma)/\Gamma_{\text{total}}^2$.
⁴ Using $B(\rho \rightarrow e^+ e^-) = (4.54 \pm 0.10) \times 10^{-5}$.
⁵ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M009R9;LINKAGE=C
 NODE=M009R9;LINKAGE=AK
 NODE=M009R9;LINKAGE=BZ
 NODE=M009R9;LINKAGE=AS
 NODE=M009R9;LINKAGE=A

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.00\pm0.21 OUR FIT					
2.90\pm0.32 OUR AVERAGE					
2.79 \pm 0.34 \pm 0.03	33k	¹ ACHASOV	07B	SND	0.6-1.38 $e^+ e^- \rightarrow \eta\gamma$
3.6 \pm 0.9		² ANDREWS	77	CNTR 0	6.7-10 γ Cu
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.21 \pm 1.39 \pm 0.20	17.4k	^{3,4} AKHMETSHIN	05	CMD2	0.60-1.38 $e^+ e^- \rightarrow \eta\gamma$
3.39 \pm 0.42 \pm 0.23		^{2,5,6} AKHMETSHIN	01B	CMD2	$e^+ e^- \rightarrow \eta\gamma$
1.9 $^{+0.6}_{-0.8}$		⁷ BENAYOUN	96	RVUE	0.54-1.04 $e^+ e^- \rightarrow \eta\gamma$
4.0 \pm 1.1		^{2,4} DOLINSKY	89	ND	$e^+ e^- \rightarrow \eta\gamma$

NODE=M009R7
 NODE=M009R7

- ¹ ACHASOV 07B reports $[\Gamma(\rho(770) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\rho(770) \rightarrow e^+ e^-)] = (1.32 \pm 0.14 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\rho(770) \rightarrow e^+ e^-) = (4.72 \pm 0.05) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.
² Solution corresponding to constructive ω - ρ interference.
³ Using $B(\rho \rightarrow e^+ e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁴ Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
⁵ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
⁶ Using $B(\rho \rightarrow e^+ e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
⁷ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution. Constructive ρ - ω interference solution.

NODE=M009R7;LINKAGE=AO

NODE=M009R7;LINKAGE=A
 NODE=M009R;LINKAGE=AK
 NODE=M009R7;LINKAGE=AZ
 NODE=M009R;LINKAGE=BQ

NODE=M009R;LINKAGE=BX

NODE=M009R7;LINKAGE=C

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{10}/Γ NODE=M009R14
NODE=M009R14**4.5±0.8 OUR FIT****4.5^{+0.9}_{-0.8} OUR AVERAGE**5.2^{+1.5}_{-1.3}±0.6 190 ¹ AKHMETSHIN 04B CMD2 0.6–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

4.1^{+1.0}_{-0.9}±0.3 295 ² ACHASOV 02F SND 0.36–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.8^{+3.4}_{-1.8}±0.5 63 ³ ACHASOV 00G SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ This branching ratio includes the conventional VMD mechanism $\rho \rightarrow \omega\pi^0$, $\omega \rightarrow \pi^0\gamma$, and the new decay mode $\rho \rightarrow f_0(500)\gamma$, $f_0(500) \rightarrow \pi^0\pi^0$ with a branching ratio $(2.0^{+1.1}_{-0.9} \pm 0.3) \times 10^{-5}$ differing from zero by 2.0 standard deviations.

NODE=M009R14;LINKAGE=AH

² This branching ratio includes the conventional VMD mechanism $\rho \rightarrow \omega\pi^0$, $\omega \rightarrow \pi^0\gamma$ and the new decay mode $\rho \rightarrow f_0(500)\gamma$, $f_0(500) \rightarrow \pi^0\pi^0$ with a branching ratio $(1.9^{+0.9}_{-0.8} \pm 0.4) \times 10^{-5}$ differing from zero by 2.4 standard deviations. Supersedes ACHASOV 00G.

NODE=M009R;LINKAGE=FF

³ Superseded by ACHASOV 02F.

NODE=M009R;LINKAGE=GF

 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 Γ_{11}/Γ_6 NODE=M009R5
NODE=M009R5**4.60±0.28 OUR FIT****4.6 ±0.2 ±0.2**

ANTIPOV

89

SIGM

 $\pi^- \text{Cu} \rightarrow \mu^+ \mu^- \pi^- \text{Cu}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.2^{+1.6}_{-3.6} ¹ ROTHWELL 69 CNTR Photoproduction5.6 ±1.5 ² WEHMANN 69 OSPK 12 $\pi^- \text{C, Fe}$ 9.7^{+3.1}_{-3.3} ^{3,4} HYAMS 67 OSPK 11 $\pi^- \text{Li, H}$

¹ Possibly large ρ - ω interference leads us to increase the minus error.

NODE=M009R5;LINKAGE=R

² Result contains $11 \pm 11\%$ correction using SU(3) for central value. The error on the correction takes account of possible ρ - ω interference and the upper limit agrees with the upper limit of $\omega \rightarrow \mu^+\mu^-$ from this experiment.

NODE=M009R5;LINKAGE=W

³ But he even enlarges his error to take residual ω contamination into account. Since his value is high, seems the other experiments also can't have too many ω 's. But maybe Hyams has additional μ 's from $\rho \rightarrow \pi\pi$, decaying π 's.

NODE=M009R5;LINKAGE=01

⁴ HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.

NODE=M009R5;LINKAGE=H

 $\Gamma(e^+e^-)/\Gamma(\pi\pi)$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 Γ_{12}/Γ_1 NODE=M009R3
NODE=M009R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.40±0.05 ^{1,2} BENAJSAS 72 OSPK $e^+e^- \rightarrow \pi^+\pi^-$

¹ The ρ' contribution is not taken into account.

NODE=M009R;LINKAGE=KS

² Barkov excludes Auslender and Benaksas for large statistical and systematic errors.

NODE=M009R3;LINKAGE=01

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{13}/Γ NODE=M009R10
NODE=M009R10**0.88±0.23±0.30**¹ LEES

21B

BABR

10.5 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.01^{+0.54}_{-0.36}±0.34 1.2M ² ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ <1.2 90 VASSERMAN 88B ND $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. Statistical evidence is more than 6σ .

NODE=M009R10;LINKAGE=A

² Statistical significance is less than 3σ .

NODE=M009R;LINKAGE=NS

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$

VALUE

CL%

DOCUMENT ID

TECN

CHG

COMMENT

 Γ_{13}/Γ_1 NODE=M009R6
NODE=M009R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

~0.01 BRAMON 86 RVUE 0 $J/\psi \rightarrow \omega\pi^0$ <0.01 84 ¹ ABRAMS 71 HBC 0 $3.7\pi^+p$

¹ Model dependent, assumes $l = 1, 2, \text{ or } 3$ for the 3π system.

NODE=M009R6;LINKAGE=G

$$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±0.9 OUR FIT					
1.8±0.9±0.3	153		AKHMETSHIN 00	CMD2	0.6-0.97 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<20	90		KURDADZE 88	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M009R13
NODE=M009R13

$$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma(\pi\pi) \quad \Gamma_{14}/\Gamma_1$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<15	90	ERBE 69	HBC	0	2.5-5.8 γp
<20		CHUNG 68	HBC	0	3.2,4.2 $\pi^- p$
<20	90	HUSON 68	HLBC	0	16.0 $\pi^- p$
<80		JAMES 66	HBC	0	2.1 $\pi^+ p$

NODE=M009R11
NODE=M009R11

$$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.60±0.74±0.18		¹ ACHASOV 09A	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 4	90	AULCHENKO 87C	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
<20	90	KURDADZE 86	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M009R8
NODE=M009R8

¹ Assuming no interference between the ρ and ω contributions.

NODE=M009R8;LINKAGE=AC

$$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	ACHASOV 08	SND	0.36-0.97 $e^+e^- \rightarrow \pi^0 e^+ e^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<1.6		AKHMETSHIN 05A	CMD2	0.72-0.84 e^+e^-

NODE=M009R15
NODE=M009R15

$$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
<0.7	AKHMETSHIN 05A	CMD2	0.72-0.84 e^+e^-

NODE=M009R16
NODE=M009R16

$\rho(770)$ REFERENCES

HOFRICHT...	24	PL B853 138698	M. Hoferichter <i>et al.</i>	(BERN, MADU, BONN+)	REFID=63010
IGNATOV	24	PR D109 112002	F.V. Ignatov <i>et al.</i>	(CMD-3 Collab.)	REFID=62672
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ACHASOV	21	JHEP 2101 113	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61040
LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
ANDREEV	20	EPJ C80 1189	V. Andreev <i>et al.</i>	(H1 Collab.)	REFID=60773
ABLIKIM	18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57650
BARTOS	17	PR D96 113004	E. Bartos <i>et al.</i>		REFID=58325
BARTOS	17A	IJMP A32 1750154	E. Bartos <i>et al.</i>		REFID=58367
ABLIKIM	16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57138
ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57513
HOFRICHT...	16	PRPL 625 1	M. Hoferichter <i>et al.</i>	(WASH, BONN)	REFID=63224
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=2
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=16761
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53567
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
DUBNICKA	10	APS 60 1	S. Dubnicka, A.Z. Dubnickova		REFID=58797
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
		Translated from ZETFP 82 841.			

NODE=M009

SCHAEL	05C	PRPL 421 191	S. Schael et al.	(ALEPH Collab.)	REFID=50845
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	MPL B580 119	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)	REFID=49610
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
ACHASOV	03	PL B559 171	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio et al.	(KLOE Collab.)	REFID=49404
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich		REFID=49399
ACHASOV	02	PR D65 032002	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02F	PL B537 201	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)	REFID=48565
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)	REFID=48167
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
PICH	01	PR D63 093005	A. Pich, J. Portoles		REFID=48313
ACHASOV	00	EPJ C12 25	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 72 411. JETPL 71 355	M.N. Achasov et al.	(Novosibirsk SND Collab.)	REFID=47929
AKHMETSHIN	00A	Translated from ZETFP 71 519. PL B475 190	R.R. Akhmetshin et al.	(Novosibirsk CMD-2 Collab.)	REFID=47421
ANDERSON	00A	PR D61 112002	S. Anderson et al.	(CLEO Collab.)	REFID=47468
ABELE	99E	PL B469 270	A. Abele et al.	(Crystal Barrel Collab.)	REFID=47414
BENAYOUN	98	EPJ C2 269	M. Benayoun et al.	(IPNP, NOVO, ADLD+)	REFID=45859
BREITWEG	98B	EPJ C2 247	J. Breitweg et al.	(ZEUS Collab.)	REFID=46354
GARDNER	98	PR D57 2716	S. Gardner, H.B. O'Connell		REFID=46366
		Also PR D62 019903 (err.)	S. Gardner, H.B. O'Connell		REFID=47981
ABELE	97	PL B391 191	A. Abele et al.	(Crystal Barrel Collab.)	REFID=45415
ADAMS	97	ZPHY C74 237	M.R. Adams et al.	(E665 Collab.)	REFID=45533
BARATE	97M	ZPHY C76 15	R. Barate et al.	(ALEPH Collab.)	REFID=45622
BERTIN	97C	PL B408 476	A. Bertin et al.	(OBELIX Collab.)	REFID=45701
BOGOLYUB...	97	PAN 60 46	M.Y. Bogolyubsky et al.	(MOSU, SERP)	REFID=45393
O'CONNELL	97	Translated from YAF 60 53. NP A623 559	H.B. O'Connell et al.	(ADLD)	REFID=45860
BENAYOUN	96	ZPHY C72 221	M. Benayoun et al.	(IPNP, NOVO)	REFID=45753
BERNICA	94	PR D50 4454	A. Bernica, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=44097
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer et al.	(ASTERIX Collab.)	REFID=43585
AGUILAR...	91	ZPHY C50 405	M. Aguilar-Benitez et al.	(LEBC-EHS Collab.)	REFID=41637
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky et al.	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn et al.	(MPIM)	REFID=45862
ANTIPOV	89	ZPHY C42 185	Y.M. Antipov et al.	(SERP, JINR, BGNA+)	REFID=40739
BISELLO	89	PL B220 321	D. Bisello et al.	(DM2 Collab.)	REFID=40740
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky et al.	(NOVO)	REFID=41003
DUBNICKA	89	JP G15 1349	S. Dubnicka et al.	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
KURDADZE	88	JETPL 47 512	L.M. Kurdadze et al.	(NOVO)	REFID=41121
VASSERMAN	88	Translated from ZETFP 47 432. SJNP 47 1035	I.B. Vasserman et al.	(NOVO)	REFID=41019
VASSERMAN	88B	Translated from YAF 47 1635. SJNP 48 480	I.B. Vasserman et al.	(NOVO)	REFID=41020
AULCHENKO	87C	Translated from YAF 48 753. IYF 87-90 Preprint	V.M. Aulchenko et al.	(NOVO)	REFID=41370
CAPRARO	87	NP B288 659	L. Capraro et al.	(CLER, FRAS, MILA+)	REFID=40003
BRAMON	86	PL B173 97	A. Bramon, J. Casulleras	(BARC)	REFID=22102
HUSTON	86	PR D33 3199	J. Huston et al.	(ROCH, FNAL, MINN)	REFID=20137
KURDADZE	86	JETPL 43 643	L.M. Kurdadze et al.	(NOVO)	REFID=40287
BARKOV	85	Translated from ZETFP 43 497. NP B256 365	L.M. Barkov et al.	(NOVO)	REFID=20134
DRUZHININ	84	PL 144B 136	V.P. Druzhinin et al.	(NOVO)	REFID=20561
CHABAUD	83	NP B223 1	V. Chabaud et al.	(CERN, CRAC, MPIM)	REFID=20131
JENSEN	83	PR D27 26	T. Jensen et al.	(ROCH, FNAL, MINN)	REFID=20132
HEYN	81	ZPHY C7 169	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20129
BOHACIK	80	PR D21 1342	J. Bohacik, H. Kuhnelt	(SLOV, WIEN)	REFID=20128
COHEN	80	PR D22 2595	D. Cohen et al.	(ANL)	REFID=20381
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)	REFID=20126
BARTALUCCI	78	NC 44A 587	S. Bartalucci et al.	(DESY, FRAS)	REFID=20122
WICKLUND	78	PR D17 1197	A.B. Wicklund et al.	(ANL)	REFID=20124
ANDREWS	77	PRL 38 198	D.E. Andrews et al.	(ROCH)	REFID=20120
DEUTSCH...	76	NP B103 426	M. Deuschmann et al.	(AACH3, BERL, BONN+)	REFID=20119
ENGLER	74	PR D10 2070	A. Engler et al.	(CMU, CASE)	REFID=20110
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer et al.	(CERN, MPIM)	REFID=20113
RATCLIFF	74	Private Comm.			REFID=40128 ERROR=3
BYERLY	73	PR D7 637	W.L. Byerly et al.	(MICH)	REFID=20104
GLADDING	73	PR D8 3721	G.E. Gladding et al.	(HARV)	REFID=20106
HYAMS	73	NP B64 134	B.D. Hyams et al.	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu et al.	(LBL)	REFID=20108
BALLAM	72	PR D5 545	J. Ballam et al.	(SLAC, LBL, TUFTS)	REFID=20094
BENAKSAS	72	PL 39B 289	D. Benaksas et al.	(ORSAY)	REFID=20096
JACOBS	72	PR D6 1291	L.D. Jacobs	(SACL)	REFID=20101
RATCLIFF	72	PL 38B 345	B.N. Ratcliff et al.	(SLAC)	REFID=20102
ABRAMS	71	PR D4 653	G.S. Abrams et al.	(LBL)	REFID=20090
ALVENSLEB...	70	PRL 24 786	H. Alvensleben et al.	(DESY)	REFID=20085
BIGGS	70	PRL 24 1197	P.J. Biggs et al.	(DARE)	REFID=20087
ERBE	69	PR 188 2060	R. Erbe et al.	(German Bubble Chamber Collab.)	REFID=20074
MALAMUD	69	Argonne Conf. 93	E.I. Malamud, P.E. Schlein	(UCLA)	REFID=20077
REYNOLDS	69	PR 184 1424	B.G. Reynolds et al.	(FSU)	REFID=20080
ROTHWELL	69	PRL 23 1521	P.L. Rothwell et al.	(NEAS)	REFID=20082
WEHMANN	69	PR 178 2095	A.A. Wehmann et al.	(HARV, CASE, SLAC+)	REFID=20084
ARMENISE	68	NC 54A 999	N. Armenise et al.	(BARI, BGNA, FIRZ+)	REFID=20054
BATON	68	PR 176 1574	J.P. Baton, G. Laurens	(SACL)	REFID=20056
CHUNG	68	PR 165 1491	S.U. Chung et al.	(LRL)	REFID=20059
FOSTER	68	NP B6 107	M. Foster et al.	(CERN, CDEF)	REFID=20061
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054
HUSON	68	PL 28B 208	R. Huson et al.	(ORSAY, MILA, UCLA)	REFID=20062
HYAMS	68	NP B7 1	B.D. Hyams et al.	(CERN, MPIM)	REFID=20063
LANZEROTTI	68	PR 166 1365	L.J. Lanzerotti et al.	(HARV)	REFID=20068
PISUT	68	NP B6 325	J. Pisut, M. Roos	(CERN)	REFID=20070
ASBURY	67B	PRL 19 865	J.G. Asbury et al.	(DESY, COLU)	REFID=20038
BACON	67	PR 157 1263	T.C. Bacon et al.	(BNL)	REFID=20039
EISNER	67	PR 164 1699	R.L. Eisner et al.	(PURD)	REFID=20046
HUWE	67	PL 24B 252	D.O. Huwe et al.	(COLU)	REFID=20049
HYAMS	67	PL 24B 634	B.D. Hyams et al.	(CERN, MPIM)	REFID=20050
MILLER	67B	PR 153 1423	D.H. Miller et al.	(PURD)	REFID=20051
ALFF...	66	PR 145 1072	C. Alff-Steinberger et al.	(COLU, RUTG)	REFID=10762
FERBEL	66	PL 21 111	T. Ferbel	(ROCH)	REFID=20028
HAGOPIAN	66	PR 145 1128	V. Hagopian et al.	(PENN, SACL)	REFID=20030
HAGOPIAN	66B	PR 152 1183	V. Hagopian, Y.L. Pan	(PENN, LRL)	REFID=20031
JACOBS	66B	UCRL 16877	L.D. Jacobs	(LRL)	REFID=20033
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
ROSS	66	PR 149 1172	M. Ross, L. Stodolsky		REFID=46380
SOEDING	66	PL B19 702	P. Soeding		REFID=46385
WEST	66	PR 149 1089	E. West et al.	(WISC)	REFID=20035
BLIEDEN	65	PL 19 444	H.R. Blieden et al.	(CERN MMS Collab.)	REFID=20016
CARMONY	64	PRL 12 254	D.D. Carmony et al.	(UCB)	REFID=20578
GOLDHABER	64	PRL 12 336	G. Goldhaber et al.	(LRL, UCB)	REFID=20013
ABOLINS	63	PRL 11 381	M.A. Abolins et al.	(UCSD)	REFID=20006

$\omega(782)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M001

 $\omega(782)$ MASS

NODE=M001M

NODE=M001M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
782.66±0.13 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
777.9 ±2.2 ^{+4.3} / _{-2.2}	900k	ANDREEV	20 H1	$e p \rightarrow e \pi^+ \pi^- p$
783.20±0.13±0.16	18680	AKHMETSHIN 05	CMD2	0.60-1.38 $e^+ e^- \rightarrow \pi^0 \gamma$
782.68±0.09±0.04	11200	¹ AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.79±0.08±0.09	1.2M	² ACHASOV 03D	RVUE	0.44-2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
781.96±0.17±0.80	11k	³ AMSLER 94C	CBAR	0.0 $\bar{p} p \rightarrow \omega \eta \pi^0$
782.08±0.36±0.82	3463	⁴ AMSLER 94C	CBAR	0.0 $\bar{p} p \rightarrow \omega \eta \pi^0$
781.96±0.13±0.17	15k	AMSLER 93B	CBAR	0.0 $\bar{p} p \rightarrow \omega \pi^0 \pi^0$
782.4 ±0.2	270k	WEIDENAUER 93	ASTE	$\bar{p} p \rightarrow 2\pi^+ 2\pi^- \pi^0$
782.4 ±0.5	7000	⁵ KEYNE 76	CNTR	$\pi^- p \rightarrow \omega n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
782.43±0.03	34M	⁶ IGNATOV 24	CMD3	$e^+ e^- \rightarrow \pi^+ \pi^-$
782.58±0.03±0.01		⁷ HOID 20	RVUE	$e^+ e^- \rightarrow \pi^0 \gamma$
781.68±0.09±0.03		⁸ COLANGELO 19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
782.63±0.03±0.01		⁹ HOFERICHT... 19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
781.91±0.24		¹⁰ LEES 12G	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
782.7 ±0.1 ±1.5	19500	¹¹ WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He} \omega$
781.78±0.10		¹¹ BARKOV 87	CMD	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.2 ±0.4	1488	¹² KURDADZE 83B	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
783.3 ±0.4	433	CORDIER 80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.5 ±0.8	33260	ROOS 80	RVUE	0.0-3.6 $\bar{p} p$
782.6 ±0.8	3000	BENKHEIRI 79	OMEG	9-12 $\pi^\pm p$
781.8 ±0.6	1430	COOPER 78B	HBC	0.7-0.8 $\bar{p} p \rightarrow 5\pi$
782.7 ±0.9	535	VANAPEL... 78	HBC	7.2 $\bar{p} p \rightarrow \bar{p} p \omega$
783.5 ±0.8	2100	GESSAROLI 77	HBC	11 $\pi^- p \rightarrow \omega n$
782.5 ±0.8	418	AGUILAR... 72B	HBC	3.9,4.6 $K^- p$
783.4 ±1.0	248	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K^+ K^- \omega$
781.0 ±0.6	510	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K_1^- K_1^+ \omega$
783.7 ±1.0	3583	¹³ COYNE 71	HBC	3.7 $\pi^+ p \rightarrow \rho \pi^+ \pi^+ \pi^- \pi^0$
784.1 ±1.2	750	ABRAMOVI... 70	HBC	3.9 $\pi^- p$
783.2 ±1.6		¹⁴ BIGGS 70B	CNTR	<4.1 $\gamma C \rightarrow \pi^+ \pi^- C$
782.4 ±0.5	2400	BIZZARRI 69	HBC	0.0 $\bar{p} p$

OCCUR=2

OCCUR=2

OCCUR=2

¹ Update of AKHMETSHIN 00C.² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega \pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.³ From the $\eta \rightarrow \gamma \gamma$ decay.⁴ From the $\eta \rightarrow 3\pi^0$ decay.⁵ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.⁶ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.⁷ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 782.736 ± 0.024 MeV.⁸ The ω mass was extracted from a dispersively improved Breit-Wigner parameterization, the ω width fixed at 8.49 ± 0.08 MeV. The value does not include vacuum polarization which would shift the mass to $781.81 \pm 0.09 \pm 0.03$ MeV. The mixing parameter is assumed real valued.⁹ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.¹⁰ From the $\rho - \omega$ interference in the $\pi^+ \pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.¹¹ Systematic uncertainties underestimated.¹² Systematic uncertainties not estimated.¹³ From best-resolution sample of COYNE 71.¹⁴ From $\omega - \rho$ interference in the $\pi^+ \pi^-$ mass spectrum assuming ω width 12.6 MeV.NODE=M001M;LINKAGE=PT
NODE=M001M;LINKAGE=VHNODE=M001M;LINKAGE=S1
NODE=M001M;LINKAGE=S2
NODE=M001M;LINKAGE=B
NODE=M001M;LINKAGE=J

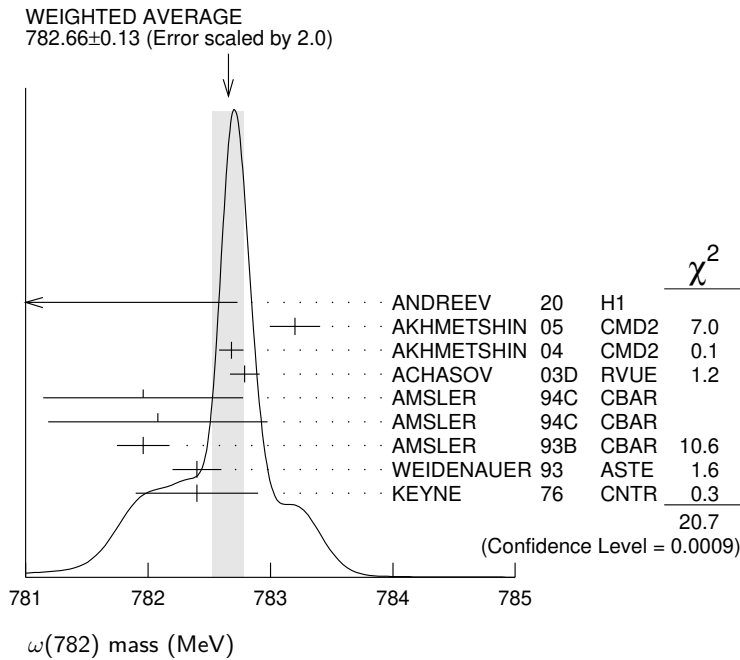
NODE=M001M;LINKAGE=G

NODE=M001M;LINKAGE=A

NODE=M001M;LINKAGE=H

NODE=M001M;LINKAGE=LE

NODE=M001M;LINKAGE=KB
NODE=M001M;LINKAGE=I
NODE=M001M;LINKAGE=D
NODE=M001M;LINKAGE=F



omega(782) WIDTH

NODE=M001W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.68±0.13 OUR AVERAGE				
8.68±0.23±0.10	11200	1 AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
8.68±0.04±0.15	1.2M	2 ACHASOV 03D	RVUE	0.44-2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
8.57±0.06	34M	3 IGNATOV 24	CMD3	$e^+ e^- \rightarrow \pi^+ \pi^-$
8.65±0.06±0.01		4 HOID 20	RVUE	$e^+ e^- \rightarrow \pi^0 \gamma$
8.71±0.04±0.04		5 HOFERICH... 19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
8.13±0.45		6 LEES 12G	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
8.2 ±0.3	19500	7 WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He} \omega$
8.4 ±0.1		8 AULCHENKO 87	ND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
8.30±0.40		7 BARKOV 87	CMD	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
9.8 ±0.9	1488	9 KURDADZE 83B	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
9.0 ±0.8	433	7 CORDIER 80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
12 ±2	1430	COOPER 78B	HBC	0.7-0.8 $p \bar{p} \rightarrow 5\pi$
9.4 ±2.5	2100	GESSAROLI 77	HBC	11 $\pi^- p \rightarrow \omega n$
10.22±0.43	20000	10 KEYNE 76	CNTR	$\pi^- p \rightarrow \omega n$
13.3 ±2	418	AGUILAR-... 72B	HBC	3.9,4.6 $K^- p$
9.1 ±0.8	451	7 BENAKSAS 72B	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
10.5 ±1.5		BORENSTEIN 72	HBC	2.18 $K^- p$
7.70±0.9 ±1.15	940	BROWN 72	MMS	2.5 $\pi^- p \rightarrow n \omega$
10.3 ±1.4	510	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K_1^+ K_1^- \omega$
12.8 ±3.0	248	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K^+ K^- \omega$
9.5 ±1.0	3583	COYNE 71	HBC	3.7 $\pi^+ p \rightarrow \rho \pi^+ \pi^+ \pi^- \pi^0$

NODE=M001W

OCCUR=2

¹ Update of AKHMETSHIN 00C.

NODE=M001W;LINKAGE=PT
NODE=M001W;LINKAGE=VH

² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega \pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

NODE=M001W;LINKAGE=H

³ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.

NODE=M001W;LINKAGE=E

⁴ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 8.63 ± 0.05 MeV.

NODE=M001W;LINKAGE=F

⁵ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.

NODE=M001W;LINKAGE=LE

⁶ From the $\rho - \omega$ interference in the $\pi^+ \pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.

NODE=M001W;LINKAGE=I

⁷ Systematic uncertainties underestimated.

⁸Relativistic Breit-Wigner includes radiative corrections. Systematic uncertainties not estimated.

⁹Systematic uncertainties not estimated.

¹⁰Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.

NODE=M001W;LINKAGE=G

NODE=M001W;LINKAGE=J
NODE=M001W;LINKAGE=B

NODE=M001215;NODE=M001

$\omega(782)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 $\pi^+\pi^-\pi^0$	(89.2 \pm 0.7) %		DESIG=1
Γ_2 $\pi^0\gamma$	(8.33 \pm 0.25) %	S=2.1	DESIG=3
Γ_3 $\pi^+\pi^-$	(1.53 \pm 0.12) %	S=1.2	DESIG=2
Γ_4 neutrals (excluding $\pi^0\gamma$)	(7 $^{+7}_{-5}$) $\times 10^{-3}$	S=1.1	DESIG=13
Γ_5 $\eta\gamma$	(4.5 \pm 0.4) $\times 10^{-4}$	S=1.1	DESIG=6
Γ_6 $\pi^0e^+e^-$	(7.7 \pm 0.6) $\times 10^{-4}$		DESIG=14
Γ_7 $\pi^0\mu^+\mu^-$	(1.34 \pm 0.18) $\times 10^{-4}$	S=1.5	DESIG=11
Γ_8 ηe^+e^-			DESIG=18
Γ_9 e^+e^-	(7.41 \pm 0.19) $\times 10^{-5}$	S=1.8	DESIG=7
Γ_{10} $\pi^+\pi^-\pi^0\pi^0$	< 2 $\times 10^{-4}$	CL=90%	DESIG=12
Γ_{11} $\pi^+\pi^-\gamma$	< 3.6 $\times 10^{-3}$	CL=95%	DESIG=4
Γ_{12} $\pi^+\pi^-\pi^+\pi^-$	< 1 $\times 10^{-3}$	CL=90%	DESIG=15
Γ_{13} $\pi^0\pi^0\gamma$	(6.7 \pm 1.1) $\times 10^{-5}$		DESIG=5
Γ_{14} $\eta\pi^0\gamma$	< 3.3 $\times 10^{-5}$	CL=90%	DESIG=17
Γ_{15} $\mu^+\mu^-$	(7.4 \pm 1.8) $\times 10^{-5}$		DESIG=8
Γ_{16} 3γ	< 1.9 $\times 10^{-4}$	CL=95%	DESIG=10
Charge conjugation (C) violating modes			
Γ_{17} $\eta\pi^0$	C < 2.1 $\times 10^{-4}$	CL=90%	NODE=M001;CLUMP=A DESIG=9
Γ_{18} $2\pi^0$	C < 2.2 $\times 10^{-4}$	CL=90%	DESIG=193
Γ_{19} $3\pi^0$	C < 2.3 $\times 10^{-4}$	CL=90%	DESIG=16
Γ_{20} invisible	< 7 $\times 10^{-5}$	CL=90%	DESIG=194

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 49 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 48.9$ for 40 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	24								
x_3	-18	-4							
x_4	-93	-55	1						
x_5	7	16	-1	-12					
x_6	-1	0	0	0	0				
x_7	0	0	0	0	0	0			
x_9	-28	-59	5	44	-28	0	0		
x_{13}	1	4	0	-2	1	0	0	-2	
x_{15}	0	0	0	0	0	0	0	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_9	x_{13}

$\omega(782)$ PARTIAL WIDTHS

$\Gamma(\pi^0\gamma)$

Γ_2

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
880 \pm 50	7815	¹ ACHASOV	13	SND 1.05-2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
788 \pm 12 \pm 27	36500	² ACHASOV	03	SND 0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$
764 \pm 51	10625	DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\gamma$

¹Systematic uncertainty not estimated.

²Using $\Gamma_\omega = 8.44 \pm 0.09$ MeV and $B(\omega \rightarrow \pi^0\gamma)$ from ACHASOV 03.

NODE=M001218

NODE=M001W1
NODE=M001W1

NODE=M001W1;LINKAGE=AC
NODE=M001W1;LINKAGE=AD

$\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

6.1±2.5	¹ DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$
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¹ Using $\Gamma_\omega = 8.4 \pm 0.1$ MeV and $B(\omega \rightarrow \eta\gamma)$ from DOLINSKY 89.

NODE=M001W2
NODE=M001W2

NODE=M001W2;LINKAGE=DA

 $\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.60 ± 0.02 OUR EVALUATION

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.591±0.015	11200	^{1,2} AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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0.653±0.003±0.021	1.2M	³ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow$
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0.600±0.031	10625	DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
-------------	-------	----------	----	----	--

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.891 \pm 0.007$ and $\Gamma_{\text{total}} = 8.44 \pm 0.09$ MeV.

² Update of AKHMETSHIN 00C.

³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

NODE=M001W7
NODE=M001W7

→ UNCHECKED ←

NODE=M001W7;LINKAGE=3P
NODE=M001W7;LINKAGE=PT
NODE=M001W;LINKAGE=VF

 $\omega(782) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M001235

 $\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_9/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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569.8±3.1±8.2	¹ LEES	21B	BABR 10.5 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
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¹ From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

NODE=M001R02
NODE=M001R02

NODE=M001R02;LINKAGE=A

 $\omega(782) \Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$

NODE=M001225

 $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma \times \Gamma_1/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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6.61±0.16 OUR FIT Error includes scale factor of 2.0. $[(6.59 \pm 0.19) \times 10^{-5}$ OUR 2024 FIT Scale factor = 2.1]

6.45±0.15 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below. $[(6.36 \pm 0.14) \times 10^{-5}$ OUR 2024 AVERAGE Scale factor = 1.3]

6.82±0.04±0.23	123k	¹ IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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6.24±0.11±0.08	11.2k	² AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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6.74±0.04±0.24	1.2M	^{3,4} ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow$
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6.37±0.35		³ DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

6.20±0.13		⁵ BENAYOUN	10	RVUE	0.4–1.05 e^+e^-
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6.70±0.06±0.27		⁶ AUBERT,B	04N	BABR	10.6 $e^+e^- \rightarrow$ $\pi^+\pi^-\pi^0\gamma$
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6.45±0.24		⁷ BARKOV	87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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5.79±0.42	1488	⁸ KURDADZE	83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
-----------	------	-----------------------	-----	------	--------------------------------------

5.89±0.54	433	⁷ CORDIER	80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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7.54±0.84	451	⁷ BENAKSAS	72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
-----------	-----	-----------------------	-----	------	--------------------------------------

¹ From a fit of the cross section using a VMD model which includes the interference of the ω and ϕ and non-resonant background, with some parameters, including ϕ mass and width, fixed at their PDG 22 values.

² Update of AKHMETSHIN 00C.

³ Recalculated by us from the cross section in the peak.

⁴ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁵ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

⁶ Superseded by LEES 21B.

⁷ Recalculated by us from the cross section in the peak. Systematic uncertainties underestimated.

⁸ Recalculated by us from the cross section in the peak. Systematic uncertainties not estimated.

NODE=M001G2
NODE=M001G2

NEW

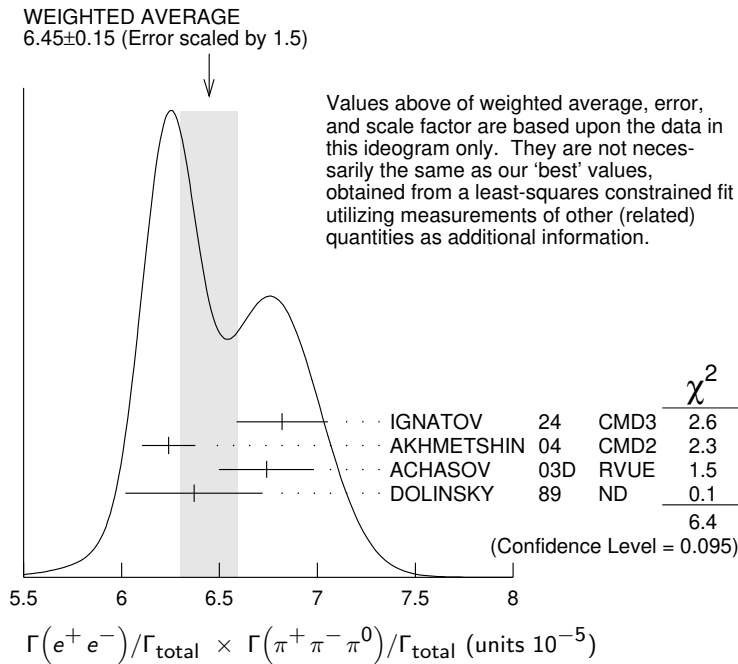
NEW

NODE=M001G2;LINKAGE=D

NODE=M001G;LINKAGE=PT
NODE=M001G;LINKAGE=LP
NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE
NODE=M001G2;LINKAGE=C
NODE=M001G2;LINKAGE=A

NODE=M001G2;LINKAGE=B



$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_2/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.17 ±0.16 OUR FIT				Error includes scale factor of 2.0. [(6.16 ± 0.14) × 10 ⁻⁶ OUR 2024 FIT Scale factor = 1.8]

NODE=M001G4
NODE=M001G4

NEW

6.34 ±0.10 OUR AVERAGE

6.336±0.056±0.089		¹ ACHASOV	16A	SND	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.47 ±0.14 ±0.39	18k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.34 ±0.21 ±0.21	10k	² DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.80 ±0.13		³ BENAYOUN	10	RVUE	0.4–1.05 e^+e^-
6.50 ±0.11 ±0.20	36k	⁴ ACHASOV	03	SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$

¹ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 03.

² Recalculated by us from the cross section in the peak.

³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

⁴ Using $\sigma(\phi \rightarrow \pi^0\gamma)$ from ACHASOV 00 and $m_\omega = 782.57$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.

NODE=M001G4;LINKAGE=A

NODE=M001G4;LINKAGE=LP

NODE=M001G4;LINKAGE=BE

NODE=M001G;LINKAGE=SH

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_3/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.225 ±0.030 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below. [(1.28 ± 0.05) × 10 ⁻⁶ OUR 2024 AVERAGE]

NODE=M001G5
NODE=M001G5

NEW

1.204±0.013±0.023	34M	¹ IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
1.318±0.051±0.021		² ACHASOV	21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
1.225±0.058±0.041	800k	³ ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.166±0.036		⁴ BENAYOUN	13	RVUE	0.4–1.05 e^+e^-
1.05 ±0.08		⁵ DAVIER	13	RVUE	$e^+e^- \rightarrow \pi^+\pi^-(\gamma)$

¹ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference with ω and ϕ masses and widths constrained by the values and their errors from PDG 22, and leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit.

² From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances. The measured phase of the $\rho(770)$ - ω interference is $(110.7 \pm 1.5 \pm 1.0)^\circ$.

³ Supersedes ACHASOV 05A.

⁴ A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$, $K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data. Supersedes BENAYOUN 10.

⁵ From $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$ data of LEES 12G.

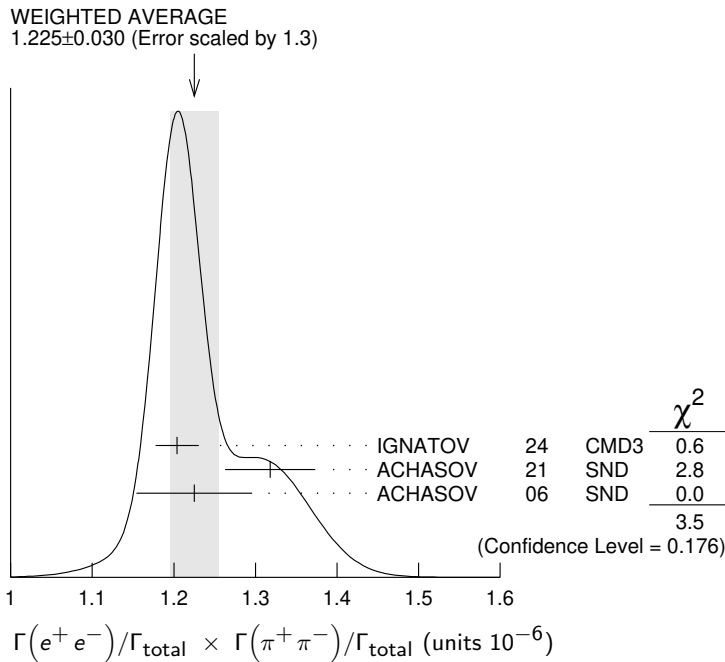
NODE=M001G5;LINKAGE=E

NODE=M001G5;LINKAGE=C

NODE=M001G5;LINKAGE=AC

NODE=M001G5;LINKAGE=B

NODE=M001G5;LINKAGE=A



$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
3.32±0.28 OUR FIT				Error includes scale factor of 1.1.
3.18±0.28 OUR AVERAGE				
3.10±0.31±0.11	33k	¹ ACHASOV 07B	SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
3.17 ^{+1.85} _{-1.31} ±0.21	17.4k	² AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
3.41±0.52±0.21	23k	^{3,4} AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
4.50±0.10		⁵ BENAYOUN 10	RVUE	0.4–1.05 e^+e^-

NODE=M001G3
NODE=M001G3

¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.

² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

⁵ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M001G3;LINKAGE=AH

NODE=M001G;LINKAGE=AH
NODE=M001G;LINKAGE=AK
NODE=M001G;LINKAGE=BQ

NODE=M001G3;LINKAGE=BE

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_{15}/\Gamma$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3±1.8±2.2	4.5M	¹ ANASTASI 17	KLOE	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

NODE=M001G01
NODE=M001G01

¹ From a fit of the real part of the vacuum polarization by a sum of the leptonic and hadronic contributions, where the hadronic contribution is parametrized as a sum of Breit-Wigner resonances $\omega(782)$, $\phi(1020)$ and using a GOUNARIS 68 parametrization for the $\rho(770)$, and a non-resonant term.

NODE=M001G01;LINKAGE=A

$\omega(782)$ BRANCHING RATIOS

NODE=M001220

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

Γ_1/Γ

NIECKNIG 12 describes final-state interactions between the three pions in a dispersive framework using data on the $\pi\pi$ P -wave scattering phase shift.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M001R21
NODE=M001R21

NODE=M001R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.9024±0.0019		¹ AMBROSINO 08G	KLOE	1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$
0.8965±0.0016±0.0048	1.2M	^{2,3} ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.880 ±0.020 ±0.032	11200	^{3,4} AKHMETSHIN 00C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.8942±0.0062		³ DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.

² Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

³ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.

⁴ Using $\Gamma(e^+e^-) = 0.60 \pm 0.02$ keV.

NODE=M001R21;LINKAGE=AM
NODE=M001R;LINKAGE=VF
NODE=M001R;LINKAGE=ZL
NODE=M001R;LINKAGE=KH

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M001R28
 NODE=M001R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.88±0.18		1	ACHASOV	16A	SND	0.60–1.38	$e^+e^- \rightarrow \pi^0\gamma$
8.09±0.14		2	AMBROSINO	08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$	
9.06±0.20±0.57	18k	3,4	AKHMETSHIN	05	CMD2	0.60-1.38	$e^+e^- \rightarrow \pi^0\gamma$
9.34±0.15±0.31	36k	4	ACHASOV	03	SND	0.60–0.97	$e^+e^- \rightarrow \pi^0\gamma$
8.65±0.16±0.42	1.2M	5,6	ACHASOV	03D	RVUE	0.44–2.00	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.39±0.24	9k	7	BENAYOUN	96	RVUE	$e^+e^- \rightarrow \pi^0\gamma$	
8.88±0.62	10k	4	DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$	

¹ Using $B(\omega \rightarrow e^+e^-)$ from PDG 15. Supersedes ACHASOV 03.

² Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.

³ Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$.

⁴ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma) / \Gamma_{\text{total}}^2$.

⁵ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

⁶ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0) / \Gamma_{\text{total}}^2$.

⁷ Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

NODE=M001R28;LINKAGE=A
 NODE=M001R28;LINKAGE=AM
 NODE=M001R;LINKAGE=AH
 NODE=M001R;LINKAGE=VL
 NODE=M001R28;LINKAGE=VF
 NODE=M001R28;LINKAGE=ZL
 NODE=M001R28;LINKAGE=A1

 $\Gamma(\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_2/Γ_1

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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NODE=M001R3
 NODE=M001R3

9.33±0.28 OUR FIT Error includes scale factor of 2.3. $[(9.35 \pm 0.30) \times 10^{-2}]$ OUR 2024 FIT Scale factor = 2.4]

NEW

9.05±0.27 OUR AVERAGE Error includes scale factor of 1.8.

8.97±0.16			AMBROSINO	08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
9.94±0.36±0.38		1	AULCHENKO	00A	SND	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
8.4 ±1.3			KEYNE	76	CNTR	$\pi^-p \rightarrow \omega n$
10.9 ±2.5			BENAKSAS	72C	OSPK	$e^+e^- \rightarrow \pi^0\gamma$
8.1 ±2.0			BALDIN	71	HLBC	$2.9 \pi^+p$
13 ±4			JACQUET	69B	HLBC	$2.05 \pi^+p \rightarrow \pi^+p\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.7 ±0.2 ±0.5		2,3	ACHASOV	03D	RVUE	0.44–2.00	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.9 ±0.7		2	DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$	

¹ From $\sigma_0^{\omega\pi^0} \rightarrow \pi^0\pi^0\gamma(m_\phi) / \sigma_0^{\omega\pi^0} \rightarrow \pi^+\pi^-\pi^0\pi^0(m_\phi)$ with a phase-space correction factor of 1/1.023.

² Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma) / \Gamma_{\text{total}}^2$.

³ Using ACHASOV 03. Based on 1.2M events.

NODE=M001R3;LINKAGE=AL

NODE=M001R3;LINKAGE=VL
 NODE=M001R3;LINKAGE=VW

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_3/Γ

See also $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M001R15
 NODE=M001R15
 NODE=M001R15

1.53±0.12 OUR FIT Error includes scale factor of 1.2.

1.49±0.13 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

1.46±0.12±0.02	900k	1	AKHMETSHIN	07		$e^+e^- \rightarrow \pi^+\pi^-$
1.30±0.24±0.05	11.2k	2	AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
2.38 ^{+1.77} _{-0.90} ±0.18	5.4k	3	ACHASOV	02E	SND	1.1–1.38 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
2.3 ±0.5			BARKOV	85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
1.6 ^{+0.9} _{-0.7}			QUENZER	78	DM1	$e^+e^- \rightarrow \pi^+\pi^-$
3.6 ±1.9			BENAKSAS	72	OSPK	$e^+e^- \rightarrow \pi^+\pi^-$

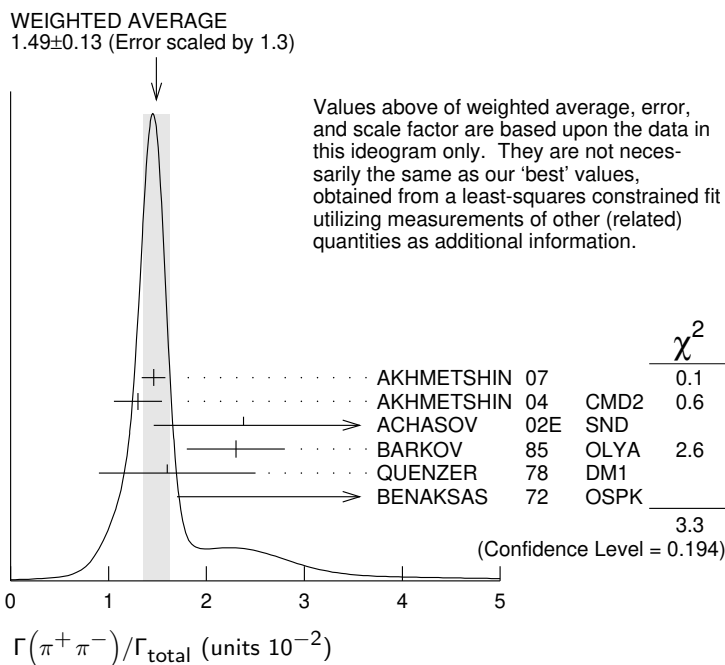
• • • We do not use the following data for averages, fits, limits, etc. • • •

1.29±0.22±0.03	970k	4,5	ABLIKIM	18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
1.28±0.22±0.03	970k	6,7	ABLIKIM	18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
1.52±0.08		8	HANHART	18	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1.75±0.11	4.5M	9	ACHASOV	05A	SND	$e^+e^- \rightarrow \pi^+\pi^-$
2.01±0.29		10	BENAYOUN	03	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1.9 ±0.3		11	GARDNER	99	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
2.3 ±0.4		12	BENAYOUN	98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
1.0 ±0.11		13	WICKLUND	78	ASPK	$3,4,6 \pi^\pm N$
1.22±0.30			ALVENSLEB...	71C	CNTR	Photoproduction
1.3 ^{+1.2} _{-0.9}			MOFFEIT	71	HBC	2.8,4.7 γp
0.80 ^{+0.28} _{-0.20}		14	BIGGS	70B	CNTR	$4.2\gamma C \rightarrow \pi^+\pi^-C$

OCCUR=3
 OCCUR=2

- 1 A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- 2 Update of AKHMETSHIN 02.
- 3 From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.
- 4 From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.
- 5 ABLIKIM 18C reports $[\Gamma(\omega(782) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \omega\gamma)] = (3.25 \pm 0.21 \pm 0.52) \times 10^{-4}$ which we divide by our best value $B(\eta'(958) \rightarrow \omega\gamma) = (2.52 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 6 From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.
- 7 ABLIKIM 18C reports $[\Gamma(\omega(782) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \omega\gamma)] = (3.22 \pm 0.21 \pm 0.52) \times 10^{-4}$ which we divide by our best value $B(\eta'(958) \rightarrow \omega\gamma) = (2.52 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 8 Dispersive analysis. Value extracted from average of data from AUBERT 09AS, AKHMETSHIN 07, ACHASOV 06, AMBROSINO 11A, BABUSCI 13D, ABLIKIM 16B normalised by PDG 16 evaluation for $\Gamma(\omega \rightarrow e^+e^-)$.
- 9 Using $\Gamma(\omega \rightarrow e^+e^-)$ from the 2004 Edition of this Review (PDG 04).
- 10 Using the data of AKHMETSHIN 02 in the hidden local symmetry model.
- 11 Using the data of BARKOV 85.
- 12 Using the data of BARKOV 85 in the hidden local symmetry model.
- 13 From a model-dependent analysis assuming complete coherence.
- 14 Re-evaluated under $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ by BEHREND 71 using more accurate $\omega \rightarrow \rho$ photoproduction cross-section ratio.

NODE=M001R15;LINKAGE=AK
 NODE=M001R15;LINKAGE=PT
 NODE=M001R;LINKAGE=VE
 NODE=M001R15;LINKAGE=E
 NODE=M001R15;LINKAGE=H
 NODE=M001R15;LINKAGE=J
 NODE=M001R15;LINKAGE=K
 NODE=M001R15;LINKAGE=D
 NODE=M001R;LINKAGE=SN
 NODE=M001R;LINKAGE=BY
 NODE=M001R15;LINKAGE=H4
 NODE=M001R15;LINKAGE=Q
 NODE=M001R15;LINKAGE=F
 NODE=M001R15;LINKAGE=B



Γ(π⁺π⁻)/Γ(π⁺π⁻π⁰)

See also Γ(π⁺π⁻)/Γ_{total}.

VALUE	DOCUMENT ID	TECN	COMMENT
0.0172±0.0014 OUR FIT	Error includes scale factor of 1.2.		
0.026 ±0.005 OUR AVERAGE			
0.021 +0.028 -0.009	1,2	RATCLIFF 72	ASPK 15 π ⁻ p → n2π
0.028 ±0.006	1	BEHREND 71	ASPK Photoproduction
0.022 +0.009 -0.01	3	ROOS 70	RVUE

- 1 The fitted width of these data is 160 MeV in agreement with present average, thus the ω contribution is overestimated. Assuming ρ width 145 MeV.
- 2 Significant interference effect observed. NB of $\omega \rightarrow 3\pi$ comes from an extrapolation.
- 3 ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

NODE=M001R2
 NODE=M001R2
 NODE=M001R2
 NODE=M001R2;LINKAGE=A
 NODE=M001R2;LINKAGE=S
 NODE=M001R2;LINKAGE=R

$\Gamma(\pi^+\pi^-)/\Gamma(\pi^0\gamma)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_2
0.20±0.04	1.98M	¹ ALOISIO	03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M001R33
 NODE=M001R33

¹ Using the data of ALOISIO 02D.

NODE=M001R;LINKAGE=KL

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$(\Gamma_2+\Gamma_4)/\Gamma$
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0.091±0.006 OUR FIT

0.081±0.011 OUR AVERAGE

0.075±0.025		BIZZARRI	71	HBC	0.0 $p\bar{p}$
0.079±0.019		DEINET	69B	OSPK	1.5 π^-p
0.084±0.015		BOLLINI	68C	CNTR	2.1 π^-p
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.073±0.018	42	BASILE	72B	CNTR	1.67 π^-p

NODE=M001R14
 NODE=M001R14

 $\Gamma(\text{neutrals})/\Gamma(\pi^+\pi^-\pi^0)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	$(\Gamma_2+\Gamma_4)/\Gamma_1$
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0.102±0.008 OUR FIT

0.103^{+0.011}_{-0.010} OUR AVERAGE

0.15 ±0.04	46	AGUILAR...	72B	HBC	3.9,4.6 K^-p
0.10 ±0.03	19	BARASH	67B	HBC	0.0 $\bar{p}p$
0.134±0.026	850	DIGIUGNO	66B	CNTR	1.4 π^-p
0.097±0.016	348	FLATTE	66	HBC	1.4–1.7 $K^-p \rightarrow \Lambda MM$
0.06 ^{+0.05} _{-0.02}		JAMES	66	HBC	2.1 π^+p
0.08 ±0.03	35	KRAEMER	64	DBC	1.2 π^+d
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.11 ±0.02	20	BUSCHBECK	63	HBC	1.5 K^-p

NODE=M001R1
 NODE=M001R1

 $\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_2/(\Gamma_2+\Gamma_4)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.78±0.07		¹ DAKIN	72	OSPK	1.4 $\pi^-p \rightarrow nMM$
>0.81	90	DEINET	69B	OSPK	

¹ Error statistical only. Authors obtain good fit also assuming $\pi^0\gamma$ as the only neutral decay.

NODE=M001R18
 NODE=M001R18

NODE=M001R18;LINKAGE=D

 $\Gamma(\text{neutrals})/\Gamma(\text{charged particles})$

VALUE	DOCUMENT ID	TECN	COMMENT	$(\Gamma_2+\Gamma_4)/(\Gamma_1+\Gamma_3)$
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0.100±0.008 OUR FIT

0.124±0.021

FELDMAN	67C	OSPK	1.2 π^-p
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NODE=M001R9
 NODE=M001R9

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
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4.5 ±0.4 OUR FIT Error includes scale factor of 1.1.

6.3 ±1.3 OUR AVERAGE Error includes scale factor of 1.2.

6.6 ±1.7		¹ ABELE	97E	CBAR	0.0 $\bar{p}p \rightarrow 5\gamma$
8.3 ±2.1		ALDE	93	GAM2	38 $\pi^-p \rightarrow \omega n$
3.0 ^{+2.5} _{-1.8}		² ANDREWS	77	CNTR	6.7–10 γCu

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2 ±0.4 ±0.1	33k	³ ACHASOV	07B	SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
4.44 ^{+2.59} _{-1.83} ±0.28	17.4k	^{4,5} AKHMETSIN	05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
5.10±0.72±0.34	23k	⁶ AKHMETSIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
0.7 to 5.5		⁷ CASE	00	CBAR	0.0 $p\bar{p} \rightarrow \eta\eta\gamma$
6.56 ^{+2.41} _{-2.55}	3525	^{2,8} BENAYOUN	96	RVUE	$e^+e^- \rightarrow \eta\gamma$
7.3 ±2.9		^{2,4} DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$

NODE=M001R19
 NODE=M001R19

- ¹ No flat $\eta\eta\gamma$ background assumed.
- ² Solution corresponding to constructive ω - ρ interference.
- ³ ACHASOV 07B reports $[\Gamma(\omega(782) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow e^+e^-)] = (3.10 \pm 0.31 \pm 0.11) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow e^+e^-) = (7.41 \pm 0.19) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.
- ⁴ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
- ⁵ Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- ⁶ Using $B(\omega \rightarrow e^+e^-) = (7.07 \pm 0.19) \times 10^{-5}$ and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$. Solution corresponding to constructive ω - ρ interference. The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively). Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
- ⁷ Depending on the degree of coherence with the flat $\eta\eta\gamma$ background and using $B(\omega \rightarrow \pi^0\gamma) = (8.5 \pm 0.5) \times 10^{-2}$.
- ⁸ Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

NODE=M001R;LINKAGE=EA
 NODE=M001R19;LINKAGE=A
 NODE=M001R19;LINKAGE=AO

NODE=M001R13;LINKAGE=WL
 NODE=M001R19;LINKAGE=AK
 NODE=M001R19;LINKAGE=TS

NODE=M001R;LINKAGE=CS

NODE=M001R19;LINKAGE=A1

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$

Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.0098 ± 0.0024	¹ ALDE 93	GAM2	38 $\pi^- p \rightarrow \omega n$
0.0082 ± 0.0033	² DOLINSKY 89	ND	$e^+e^- \rightarrow \eta\gamma$
0.010 ± 0.045	APEL 72B	OSPK	4-8 $\pi^- p \rightarrow n3\gamma$

NODE=M001R11
 NODE=M001R11

- ¹ Model independent determination.
- ² Solution corresponding to constructive ω - ρ interference.

NODE=M001R11;LINKAGE=A
 NODE=M001R11;LINKAGE=K

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$

Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7 ± 0.6 OUR FIT				
7.7 ± 0.6 OUR AVERAGE				
7.61 ± 0.53 ± 0.64		ACHASOV 08	SND	0.36-0.97 $e^+e^- \rightarrow \pi^0 e^+e^-$
8.19 ± 0.71 ± 0.62		AKHMETSHIN 05A	CMD2	0.72-0.84 e^+e^-
5.9 ± 1.9	43	DOLINSKY 88	ND	$e^+e^- \rightarrow \pi^0 e^+e^-$

NODE=M001R23
 NODE=M001R23

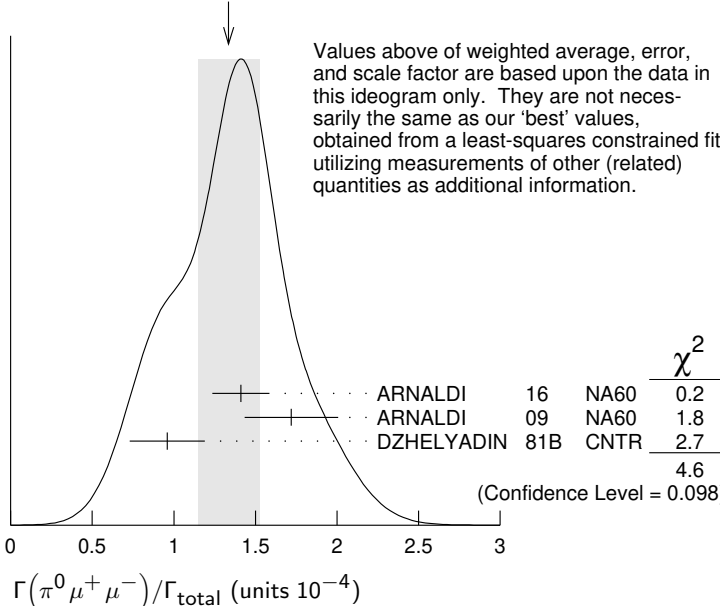
$\Gamma(\pi^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$

Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.34 ± 0.18 OUR FIT Error includes scale factor of 1.5.				
1.34 ± 0.19 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
1.41 ± 0.09 ± 0.15		ARNALDI 16	NA60	400 GeV (p -A) collisions
1.72 ± 0.25 ± 0.14	3k	ARNALDI 09	NA60	158A In-In collisions
0.96 ± 0.23		DZHELADIN 81B	CNTR	25-33 $\pi^- p \rightarrow \omega n$

NODE=M001R12
 NODE=M001R12

WEIGHTED AVERAGE
 1.34 ± 0.19 (Error scaled by 1.5)



$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M001R34
 NODE=M001R34

••• We do not use the following data for averages, fits, limits, etc. •••

<1.1	AKHMETSHIN 05A	CMD2	0.72-0.84 $e^+ e^-$
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 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M001R13
 NODE=M001R13

0.741±0.019 OUR FIT Error includes scale factor of 1.8. $[(0.738 \pm 0.022) \times 10^{-4} \text{ OUR } 2024 \text{ FIT Scale factor} = 1.9]$

NEW

••• We do not use the following data for averages, fits, limits, etc. •••

0.700±0.016	11200	^{1,2} AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.752±0.004±0.024	1.2M	^{2,3} ACHASOV 03D	RVUE	0.44-2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.714±0.036		² DOLINSKY 89	ND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.72 ±0.03		² BARKOV 87	CMD	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.64 ±0.04	1488	² KURDADZE 83B	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.675±0.069	433	² CORDIER 80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.83 ±0.10	451	² BENAKSAS 72B	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.77 ±0.06		⁴ AUGUSTIN 69D	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.65 ±0.13	33	⁵ ASTVACAT...	68 OSPK	Assume SU(3)+mixing

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = 0.891 \pm 0.007$. Update of AKHMETSHIN 00C.

² Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}^2$.

³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+ \pi^-) = (1.70 \pm 0.28)\%$.

⁴ Rescaled by us to correspond to ω width 8.4 MeV. Systematic errors underestimated.

⁵ Not resolved from ρ decay. Error statistical only.

NODE=M001R13;LINKAGE=4P

NODE=M001R13;LINKAGE=ZL

NODE=M001R13;LINKAGE=VF

NODE=M001R13;LINKAGE=E

NODE=M001R13;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M001R5
 NODE=M001R5

< 2	90	ACHASOV 09A	SND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
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••• We do not use the following data for averages, fits, limits, etc. •••

<200	90	KURDADZE 86	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
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 $\Gamma(\pi^+ \pi^- \gamma)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M001R22
 NODE=M001R22

<0.0036	95	WEIDENAUER 90	ASTE	$p\bar{p} \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
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••• We do not use the following data for averages, fits, limits, etc. •••

<0.004	95	BITYUKOV 88B	SPEC	$32 \pi^- p \rightarrow \pi^+ \pi^- \gamma X$
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 $\Gamma(\pi^+ \pi^- \gamma)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_{11}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M001R4
 NODE=M001R4

••• We do not use the following data for averages, fits, limits, etc. •••

<0.066	90	KALBFLEISCH 75	HBC	2.18 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
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<0.05	90	FLATTE 66	HBC	1.2 - 1.7 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
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 $\Gamma(\pi^+ \pi^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M001R24
 NODE=M001R24

<1 × 10 ⁻³	90	KURDADZE 88	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$
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 $\Gamma(\pi^0 \pi^0 \gamma)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M001R29
 NODE=M001R29

6.7±1.1 OUR FIT

6.5±1.2 OUR AVERAGE

6.4 ^{+2.4} _{-2.0} ±0.8	190	¹ AKHMETSHIN 04B	CMD2	0.6-0.97 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
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6.6 ^{+1.4} _{-1.3} ±0.6	295	ACHASOV 02F	SND	0.36-0.97 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
--	-----	-------------	-----	--

••• We do not use the following data for averages, fits, limits, etc. •••

11.8 ^{+2.1} _{-1.9} ±1.4	190	² AKHMETSHIN 04B	CMD2	0.6-0.97 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
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OCCUR=2

7.8±2.7±2.0	63	^{1,3} ACHASOV 00G	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
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12.7±2.3±2.5	63	^{2,3} ACHASOV 00G	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
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OCCUR=2

¹ In the model assuming the $\rho \rightarrow \pi^0 \pi^0 \gamma$ decay via the $\omega\pi$ and $f_0(500)\gamma$ mechanisms.

² In the model assuming the $\rho \rightarrow \pi^0 \pi^0 \gamma$ decay via the $\omega\pi$ mechanism only.

³ Superseded by ACHASOV 02F.

NODE=M001R29;LINKAGE=A

NODE=M001R29;LINKAGE=B

NODE=M001R;LINKAGE=GF

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{13}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.00045	90	DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<0.08	95	JACQUET 69B	HLBC	$2.05 \pi^+p \rightarrow \pi^+p\omega$

NODE=M001R10
 NODE=M001R10

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\pi^0\gamma)$ Γ_{13}/Γ_2

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±1.3 OUR FIT					
8.5±2.9	40 ± 14		ALDE 94B	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0\gamma n$
< 50	90		DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<1800	95		KEYNE 76	CNTR	$\pi^-p \rightarrow \omega n$
<1500	90		BENAKSAS 72C	OSPK	e^+e^-
<1400			BALDIN 71	HLBC	$2.9 \pi^+p$
<1000	90		BARMIN 64	HLBC	$1.3-2.8 \pi^-p$

NODE=M001R7
 NODE=M001R7

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\text{neutrals})$ $\Gamma_{13}/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.22±0.07		¹ DAKIN 72	OSPK	$1.4 \pi^-p \rightarrow nMM$
<0.19	90	DEINET 69B	OSPK	

¹ See $\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$.

NODE=M001R17
 NODE=M001R17

NODE=M001R17;LINKAGE=D

 $\Gamma(\eta\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	AKHMETSHIN 04B	CMD2	$0.6-0.97 e^+e^- \rightarrow \eta\pi^0\gamma$

NODE=M001R32
 NODE=M001R32

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
7.4±1.8 OUR FIT				
7.4±1.8 OUR AVERAGE				
6.6±1.4±1.7	4.5M	¹ ANASTASI 17	KLOE	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
9.0±2.9±1.1	18	HEISTER 02C	ALEP	$Z \rightarrow \mu^+\mu^- + X$

NODE=M001R30
 NODE=M001R30

¹ Assuming lepton universality in the decay $\omega \rightarrow \ell^+\ell^-$ and correcting for different phase space between electron and muon final states.

NODE=M001R30;LINKAGE=A

 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{15}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.2	90	WILSON 69	OSPK	$12 \pi^-C \rightarrow Fe$
<1.7	74	FLATTE 66	HBC	$1.2 - 1.7 K^-p \rightarrow \Lambda\mu^+\mu^-$
<1.2		BARBARO-... 65	HBC	$2.7 K^-p$

NODE=M001R6
 NODE=M001R6

 $\Gamma(\pi^0\mu^+\mu^-)/\Gamma(\mu^+\mu^-)$ Γ_7/Γ_{15}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.6	30	¹ DZHELYADIN 79	CNTR	$25-33 \pi^-p$

NODE=M001R20
 NODE=M001R20

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20;LINKAGE=S

 $\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	¹ ABELE 97E	CBAR	$0.0 \bar{p}p \rightarrow 5\gamma$
<2	90	¹ PROKOSHKIN 95	GAM2	$38 \pi^-p \rightarrow 3\gamma n$

NODE=M001R27
 NODE=M001R27

¹ From direct 3γ decay search.

NODE=M001R27;LINKAGE=A

 $\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.001	90	ALDE 94B	GAM2	$38\pi^-p \rightarrow \eta\pi^0 n$

NODE=M001R25
 NODE=M001R25
 NODE=M001R25

Violates C conservation.
 ••• We do not use the following data for averages, fits, limits, etc. •••

$$\frac{[\Gamma(\eta\gamma) + \Gamma(\eta\pi^0)]/\Gamma(\pi^+\pi^-\pi^0)}{(\Gamma_5 + \Gamma_{17})/\Gamma_1}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.016	90	¹ FLATTE	66 HBC	1.2 – 1.7 $K^- p \rightarrow \Lambda\pi^+\pi^-$ MM

NODE=M001R8
NODE=M001R8

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.045 95 JACQUET 69B HLBC 2.05 $\pi^+ p \rightarrow \pi^+ p\omega$

¹ Restated by us using $B(\eta \rightarrow \text{charged modes}) = 29.2\%$.

NODE=M001R8;LINKAGE=A

$$\frac{\Gamma(\eta\pi^0)/\Gamma(\pi^0\gamma)}{\Gamma_{17}/\Gamma_2}$$

Violates C conservation.

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	¹ STAROSTIN 09	CRYM	$\gamma p \rightarrow \eta\pi^0 p$

NODE=M001R35
NODE=M001R35
NODE=M001R35

¹ STAROSTIN 09 reports $[\Gamma(\omega(782) \rightarrow \eta\pi^0)/\Gamma(\omega(782) \rightarrow \pi^0\gamma)] \times [B(\eta \rightarrow 2\gamma)] < 1.01 \times 10^{-3}$ which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M001R35;LINKAGE=ST

$$\frac{\Gamma(2\pi^0)/\Gamma(\pi^0\gamma)}{\Gamma_{18}/\Gamma_2}$$

Violates C conservation and Bose-Einstein statistics.

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.59	90	STAROSTIN 09	CRYM	$\gamma p \rightarrow 2\pi^0 p$

NODE=M001R36
NODE=M001R36
NODE=M001R36

$$\frac{\Gamma(3\pi^0)/\Gamma_{\text{total}}}{\Gamma_{19}/\Gamma}$$

Violates C conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 3×10^{-4}	90	PROKOSHKIN 95	GAM2	$38 \pi^- p \rightarrow 3\pi^0 n$

NODE=M001R26
NODE=M001R26
NODE=M001R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$\frac{\Gamma(3\pi^0)/\Gamma(\pi^0\gamma)}{\Gamma_{19}/\Gamma_2}$$

Violates C conservation.

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.72	90	STAROSTIN 09	CRYM	$\gamma p \rightarrow 3\pi^0 p$

NODE=M001R37
NODE=M001R37
NODE=M001R37

$$\frac{\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)}{\Gamma_{19}/\Gamma_1}$$

Violates C conservation.

VALUE	CL%	DOCUMENT ID	COMMENT
<0.009	90	BARBERIS 01	450 $p p \rightarrow p_f 3\pi^0 p_s$

NODE=M001R31
NODE=M001R31
NODE=M001R31

• • • We do not use the following data for averages, fits, limits, etc. • • •

$$\frac{\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\pi^0)}{\Gamma_{20}/\Gamma_1}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8.1×10^{-5}	90	ABLIKIM 18S	BES3	$J/\psi \rightarrow \omega\eta \rightarrow \omega\pi^+\pi^-\pi^0$

NODE=M001R01
NODE=M001R01

PARAMETER Λ IN $\omega \rightarrow \pi^0 \ell^+ \ell^-$ DECAY

NODE=M001230

In the pole approximation the electromagnetic transition form factor for a resonance of mass M is given by the expression:

$$|F|^2 = (1 - M^2/\Lambda^2)^{-2},$$

where for the parameter Λ vector dominance predicts $\Lambda = M_p \approx 0.770$ GeV. The ARNALDI 09 measurement is in obvious conflict with this expectation. Note that for $\eta \rightarrow \gamma\mu^+\mu^-$ decay ARNALDI 09 and DZHELYADIN 80 obtain the value of Λ consistent with vector dominance.

NODE=M001230

PARAMETER Λ IN $\omega \rightarrow \pi^0 \mu^+ \mu^-$ DECAY

NODE=M001LAM
NODE=M001LAM

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.670 ± 0.006 OUR AVERAGE				
0.6707 ± 0.0039 ± 0.0056		¹ ARNALDI 16	NA60	400 GeV (p -A) collisions
0.668 ± 0.009 ± 0.003	3k	² ARNALDI 09	NA60	158A In-In collisions

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.65 ± 0.03 DZHELYADIN 81B CNTR 25–33 $\pi^- p \rightarrow \omega n$

¹ ARNALDI 16 reports $\Lambda^{-2}(\omega) = 2.223 \pm 0.026 \pm 0.037$ GeV⁻² which we converted to the quoted Λ value.

NODE=M001LAM;LINKAGE=A

² ARNALDI 09 reports $\Lambda^{-2}(\omega) = 2.24 \pm 0.06 \pm 0.02$ GeV⁻² which we converted to the quoted Λ value.

NODE=M001LAM;LINKAGE=B

PARAMETER Λ IN $\omega \rightarrow \pi^0 e^+ e^-$ DECAY

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.709 ± 0.037	1.1k	¹ ADLARSON	17B A2MM	$\gamma p \rightarrow \omega p$
¹ ADLARSON 17B reports $\Lambda^{-2}(\omega\pi^0) = 1.99 \pm 0.21 \text{ GeV}^{-2}$ that we converted to the quoted Λ value.				

NODE=M001A02
 NODE=M001A02

NODE=M001A02;LINKAGE=A

ENERGY DEPENDENCE OF $\omega \rightarrow \pi^+ \pi^- \pi^0$ DALITZ PLOT

The following experiments fit to one or more of the coefficients α, β, γ for |matrix element|² $\propto P (1 + 2\alpha Z + 2\beta Z^{3/2} \sin(3\phi) + 2\gamma Z^2 + O(Z^{5/2}))$ where P is the P -wave phase-space factor and Z, ϕ are kinematical variables as defined in ADLARSON 17.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.133 ± 0.008 OUR AVERAGE				
0.1321 ± 0.0067 ± 0.0046	260k	¹ ABLIKIM	18AD BES3	$J/\psi \rightarrow \omega \eta$
0.147 ± 0.036	44k	ADLARSON	17 WASA	α in $p d \rightarrow {}^3\text{He } \omega$, $pp \rightarrow pp\omega$

¹Keeping a term linear in Z only. A fit with the terms proportional to Z and $Z^{3/2}$ gives $\alpha = 0.133 \pm 0.041$ and $\beta = 0.037 \pm 0.054$.

NODE=M001A00

NODE=M001A00

NODE=M001A00

NODE=M001A00;LINKAGE=A

 $\omega(782)$ REFERENCES

IGNATOV	24	PR D109 112002	F.V. Ignatov <i>et al.</i>	(CMD-3 Collab.)	REFID=62672
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ACHASOV	21	JHEP 2101 113	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61040
LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
ANDREEV	20	EPJ C80 1189	V. Andreev <i>et al.</i>	(H1 Collab.)	REFID=60773
HOID	20	EPJ C80 988	B.-L. Hoid, M. Hoferichter, B. Kubis	(BONN, BERN)	REFID=61048
COLANGELO	19	JHEP 1902 006	G. Colangelo, M. Hoferichter, P. Stoffer	(BERN+)	REFID=59585
HOFRICHT...	19	JHEP 1908 137	M. Hoferichter, B.-L. Hoid, B. Kubis	(WASH, BONN)	REFID=60974
ABLIKIM	18AD	PR D98 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59498
ABLIKIM	18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ABLIKIM	18S	PR D98 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58971
HANHART	18	EPJ C78 450	C. Hanhart <i>et al.</i>		REFID=59186
ADLARSON	17	PL B770 418	P. Adlarson <i>et al.</i>	(WASA-at-COSY Collab.)	REFID=57907
ADLARSON	17B	PR C95 035208	P. Adlarson <i>et al.</i>	(A2 Collab. at MAMI)	REFID=58155
ANASTASI	17	PL B767 485	A. Anastasi <i>et al.</i>	(KLOE-2 Collab.)	REFID=57887
ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57126
ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57513
ARNALDI	16	PL B757 437	R. Arnaldi <i>et al.</i>	(NA60 Collab.)	REFID=57220
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=4
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
BABUSCI	13D	PL B720 336	D. Babusci <i>et al.</i>	(CATA, CALB, BARI)	REFID=55337
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono	(PARIN, BERLIN+)	REFID=55357
DAVIER	13	EPJ C73 2597	M. Davier <i>et al.</i>		REFID=55499
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)	REFID=54305
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
ARNALDI	09	PL B677 260	R. Arnaldi <i>et al.</i>	(NA60 Collab.)	REFID=52720
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
STAROSTIN	09	PR C79 065201	A. Starostin <i>et al.</i>	(Crystal Ball Collab. at MAMI)	REFID=53001
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52573
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
Translated from ZETFP 72 411.					

NODE=M001

ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
AKHMETSHIN	00C	Translated from ZETFP 71 519.	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
AULCHENKO	00A	PL B476 33	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
CASE	00	JETP 90 927	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	Translated from ZETF 117 1067.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D61 032002	S. Gardner, H.B. O'Connell	(IPNP, NOVO, ADLD+)	REFID=46919
BENAYOUN	98	PL B462 365	M. Benayoun <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45859
ABELE	97E	PR D59 076002	A. Abele <i>et al.</i>	(IPNP, NOVO)	REFID=45755
BENAYOUN	96	EPJ C2 269	M. Benayoun <i>et al.</i>	(SERP)	REFID=44616
PROKOSHKIN	95	PL B411 361	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=45209
WURZINGER	95	ZPHY C72 221	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=44100
ALDE	94B	PD 40 273	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44091
AMSLER	94C	Translated from DANS 342 610.	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
ALDE	93	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
Also		Translated from YAF 56 137.	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
AMSLER	93B	ZPHY C61 35	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	PL B311 362	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ANTONELLI	92	ZPHY C59 387	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
DOLINSKY	91	ZPHY C56 15	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
WEIDENAUER	90	PRPL 202 99	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
DOLINSKY	89	ZPHY C47 353	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BITYUKOV	88B	ZPHY C42 511	S.I. Bitjukov <i>et al.</i>	(SERP)	REFID=41021
DOLINSKY	88	SJNP 47 800	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
KURDADZE	88	Translated from YAF 47 1258.	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
AULCHENKO	87	SJNP 48 277	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40007
BARKOV	87	Translated from YAF 48 442.	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
KURDADZE	86	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BARKOV	85	Translated from ZETFP 47 432.	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
DRUZHININ	84	NP B256 365	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
KURDADZE	83B	PL 144B 136	A.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20244
DZHELADIN	81B	JETPL 36 274	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=20242
CORDIER	80	Translated from ZETFP 36 221.	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
DZHELADIN	80	PL 102B 296	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=10831
ROOS	80	NP B172 13	M. Roos, A. Pellinen	(HEL5)	REFID=20241
BENKHEIRI	79	PL 94B 548	P. Benkheiri <i>et al.</i>	(EPOL, CERN, CDEF+)	REFID=20238
DZHELADIN	79	LCN 27 321	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=20239
COOPER	78B	NP B150 268	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
QUENZER	78	PL 84B 143	A. Quenzer <i>et al.</i>	(LALO)	REFID=20123
VANAPEL...	78	NP B146 1	G.W. van Apeldoorn <i>et al.</i>	(ZEEM)	REFID=20234
WICKLUND	78	PL 76B 512	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
ANDREWS	77	NP B133 245	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
GESSAROLI	77	PR D17 1197	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
KEYNE	76	NP B126 382	J. Keyne <i>et al.</i>	(LOIC, SHMP)	REFID=20226
Also		PR D14 28	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
KALBFLEISCH	75	PR D8 2789	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AGUILAR...	72B	PR D11 987	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72B	PL D6 29	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20206
BASILE	72B	PL 41B 234	M. Basile <i>et al.</i>	(CERN)	REFID=20207
BENAKSAS	72	Phil. Conf. 153	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72B	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20209
BENAKSAS	72C	PL 42B 507	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20517
BORENSTEIN	72	PL 42B 511	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
BROWN	72	PR D5 1559	R.M. Brown <i>et al.</i>	(ILL, ILLC)	REFID=20211
DAKIN	72	PL 42B 117	J.T. Dakin <i>et al.</i>	(PRIN)	REFID=20212
RATCLIFF	72	PR D6 2321	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
ALVENSLEB...	71C	PL 38B 345	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20193
BALDIN	71	PRL 27 888	A.B. Baldin <i>et al.</i>	(ITEP)	REFID=20195
BEHREND	71	SJNP 13 758	H.J. Behrend <i>et al.</i>	(ROCH, CORN, FNAL)	REFID=20197
BIZZARRI	71	Translated from YAF 13 1318.	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20198
COYNE	71	PRL 27 61	D.G. Coyne <i>et al.</i>	(LRL)	REFID=20201
MOFFFEIT	71	NP B27 140	K.C. Moffeit <i>et al.</i>	(LRL, UCB, SLAC+)	REFID=20204
ABRAMOVI...	70	NP B32 333	M. Abramovich <i>et al.</i>	(CERN)	REFID=20180
BIGGS	70B	NP B29 349	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20184
BIZZARRI	70	NP B20 209	R. Bizzarri <i>et al.</i>	(ROMA, SYRA)	REFID=20181
ROOS	70	PRL 24 1201	M. Roos	(CERN)	REFID=20191
Proc. Daresbury Study Weekend No. 1.					
AUGUSTIN	69D	PNL R7 173	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=20169
BIZZARRI	69	PL 28B 513	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
DEINET	69B	NP B14 169	W. Deinet <i>et al.</i>	(KARL, CERN)	REFID=20173
JACQUET	69B	PL 30B 426	F. Jacquet <i>et al.</i>	(EPOL, BERG)	REFID=20176
WILSON	69	NC 63A 743	R. Wilson	(HARV)	REFID=20179
Also		Private Comm.	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
ASTVACAT...	68C	PR 178 2095	R.G. Astvatsaturov <i>et al.</i>	(JINR, MOSU)	REFID=20055
BOLLINI	68	PL 27B 45	D. Bollini <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20164
GOUNARIS	68	NC 56A 531	G.J. Gounaris, J.J. Sakurai	(COLU)	REFID=48054
BARASH	67B	PRL 21 244	N. Barash <i>et al.</i>	(PENN)	REFID=20160
FELDMAN	67C	PR 156 1399	M. Feldman <i>et al.</i>	(NAPL, FRAS, TRST)	REFID=20156
DIGIUGNO	66B	PR 159 1219	G. Di Giugno <i>et al.</i>	(LRL)	REFID=20157
FLATTE	66	NC 44A 1272	S.M. Flatte <i>et al.</i>	(YALE, BNL)	REFID=10770
JAMES	66	PR 145 1050	F.E. James, H.L. Kraybill	(LRL)	REFID=20152
BARBARO...	65	PR 142 896	A. Barbaro-Galtieri, R.D. Tripp	(ITEP)	REFID=20149
BARMIN	64	PRL 14 279	V.V. Barmin <i>et al.</i>		
KRAEMER	64	JETP 18 1289	R.W. Kraemer <i>et al.</i>	(JHU, NWES, WOOD)	REFID=10755
BUSCHBECK	63	Translated from ZETF 45 1879.	B. Buschbeck <i>et al.</i>	(VIEN, CERN, ANIK)	REFID=20146
		PR 136 B496			
		Siena Conf. 1 166			

$\eta'(958)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

NODE=M002

 $\eta'(958)$ MASS

NODE=M002M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
957.78 ±0.06 OUR AVERAGE				
957.793±0.054±0.036	3.9k	LIBBY	08	CLEO $J/\psi \rightarrow \gamma\eta'$
957.9 ±0.2 ±0.6	4800	WURZINGER	96	SPEC 1.68 $p d \rightarrow {}^3\text{He}\eta'$
957.46 ±0.33		DUANE	74	MMS $\pi^- p \rightarrow n\text{MM}$
958.2 ±0.5	1414	DANBURG	73	HBC 2.2 $K^- p \rightarrow \Lambda\eta'$
958 ±1	400	JACOBS	73	HBC 2.9 $K^- p \rightarrow \Lambda\eta'$
956.1 ±1.1	3415	¹ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n\eta'$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
957.5 ±0.2		BAI	04J	BES2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
959 ±1	630	² BELADIDZE	92C	VES 36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
958 ±1	340	² ARMSTRONG	91B	OMEG 300 $pp \rightarrow pp\eta\pi^+\pi^-$
958.2 ±0.4	622	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
957.8 ±0.2	2420	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
956.3 ±1.0	143	² GIDAL	87	MRK2 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
957.4 ±1.4	535	³ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n\eta'$
957 ±1		RITTENBERG	69	HBC 1.7-2.7 $K^- p$

NODE=M002M

OCCUR=2

OCCUR=2

¹ Using all η' decays.² Systematic uncertainty not estimated.³ Using η' decays into neutrals. Not independent of the other listed BASILE 71 η' mass measurement.

NODE=M002M;LINKAGE=BS

NODE=M002M;LINKAGE=NS

NODE=M002M;LINKAGE=BA

 $\eta'(958)$ WIDTH

NODE=M002W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.006 OUR FIT					
0.230±0.021 OUR AVERAGE					
0.226±0.017±0.014	2300	CZERWINSKI	10	MMS	$pp \rightarrow pp\eta'$
0.40 ±0.22	4800	WURZINGER	96	SPEC	1.68 $p d \rightarrow {}^3\text{He}\eta'$
0.28 ±0.10	1000	BINNIE	79	MMS	0 $\pi^- p \rightarrow n\text{MM}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.20 ±0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M002W

 $\eta'(958)$ DECAY MODES

NODE=M002215;NODE=M002

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\pi^+\pi^-\eta$	(42.5 ±0.5)%	DESIG=1
Γ_2 $\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.48 ±0.35)%	DESIG=9
Γ_3 $\rho^0\gamma$		DESIG=213
Γ_4 $\pi^0\pi^0\eta$	(22.4 ±0.5)%	DESIG=2
Γ_5 $\omega\gamma$	(2.52 ±0.07)%	DESIG=7
Γ_6 ωe^+e^-	(2.0 ±0.4) × 10 ⁻⁴	DESIG=205
Γ_7 $\gamma\gamma$	(2.307±0.033)%	DESIG=6
Γ_8 $3\pi^0$	(2.50 ±0.17) × 10 ⁻³	DESIG=8
Γ_9 $\mu^+\mu^-\gamma$	(1.13 ±0.28) × 10 ⁻⁴	DESIG=20
Γ_{10} $\pi^+\pi^-\mu^+\mu^-$	(2.13 ±0.13) × 10 ⁻⁵	DESIG=201
Γ_{11} $\pi^+\pi^-\pi^0$	(3.61 ±0.17) × 10 ⁻³	DESIG=121
Γ_{12} $(\pi^+\pi^-\pi^0)$ S-wave	(3.8 ±0.5) × 10 ⁻³	DESIG=211
Γ_{13} $\pi^\mp\rho^\pm$	(7.4 ±2.3) × 10 ⁻⁴	DESIG=210
Γ_{14} $2(\pi^+\pi^-)$	(8.51 ±0.33) × 10 ⁻⁵	DESIG=131
Γ_{15} $\pi^+\pi^-2\pi^0$	(2.11 ±0.15) × 10 ⁻⁴	DESIG=202
Γ_{16} $2(\pi^+\pi^-)$ neutrals	< 1 %	95% DESIG=132

Γ_{17}	$2(\pi^+\pi^-)\pi^0$	< 1.8	$\times 10^{-3}$	90%	DESIG=141
Γ_{18}	$2(\pi^+\pi^-)2\pi^0$	< 1	%	95%	DESIG=15
Γ_{19}	$3(\pi^+\pi^-)$	< 3.1	$\times 10^{-5}$	90%	DESIG=203
Γ_{20}	$K^\pm\pi^\mp$	< 4	$\times 10^{-5}$	90%	DESIG=207
Γ_{21}	$\pi^+\pi^-e^+e^-$	(2.43 ± 0.06)	$\times 10^{-3}$		DESIG=10
Γ_{22}	$\pi^+e^-\nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%	DESIG=204
Γ_{23}	γe^+e^-	(4.80 ± 0.15)	$\times 10^{-4}$		DESIG=28
Γ_{24}	$\pi^0\gamma\gamma$	(3.20 ± 0.24)	$\times 10^{-3}$		DESIG=24
Γ_{25}	$\pi^0\gamma\gamma(\text{non resonant})$	(6.2 ± 0.9)	$\times 10^{-4}$		DESIG=212
Γ_{26}	$\eta\gamma\gamma$	< 1.33	$\times 10^{-4}$	90%	DESIG=214
Γ_{27}	$4\pi^0$	< 1.2	$\times 10^{-5}$	90%	DESIG=26
Γ_{28}	e^+e^-	< 5.6	$\times 10^{-9}$	90%	DESIG=150
Γ_{29}	$e^+e^-e^+e^-$	(4.5 ± 1.1)	$\times 10^{-6}$		DESIG=215
Γ_{30}	invisible	< 2.1	$\times 10^{-4}$	90%	DESIG=200
Γ_{31}	γ Dark Photon	5.0×10^{-07} to 3.50×10^{-06}		90%	DESIG=217

**Charge conjugation (C), Parity (P),
Lepton family number (LF) violating modes**

NODE=M002;CLUMP=B

Γ_{32}	$\pi^+\pi^-$	P, CP	< 1.8	$\times 10^{-5}$	90%	DESIG=111
Γ_{33}	$\pi^0\pi^0$	P, CP	< 4	$\times 10^{-4}$	90%	DESIG=25
Γ_{34}	$\pi^0e^+e^-$	C [a]	< 1.4	$\times 10^{-3}$	90%	DESIG=16
Γ_{35}	$\pi^0\rho^0$	C	< 4	%	90%	DESIG=18
Γ_{36}	ηe^+e^-	C [a]	< 2.4	$\times 10^{-3}$	90%	DESIG=17
Γ_{37}	3γ	C	< 1.0	$\times 10^{-4}$	90%	DESIG=23
Γ_{38}	$\mu^+\mu^-\pi^0$	C [a]	< 6.0	$\times 10^{-5}$	90%	DESIG=22
Γ_{39}	$\mu^+\mu^-\eta$	C [a]	< 1.5	$\times 10^{-5}$	90%	DESIG=21
Γ_{40}	$e\mu$	LF	< 4.7	$\times 10^{-4}$	90%	DESIG=27
Γ_{41}	$\pi^+\pi^-\text{ALP} \rightarrow$ $\pi^+\pi^-e^+e^-$		< 1.9	$\times 10^{-5}$	90%	DESIG=218

[a] C parity forbids this to occur as a single-photon process.

LINKAGE=CS

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, 2 combinations of partial widths obtained from integrated cross section, and 21 branching ratios uses 53 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 69.5$ for 45 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-24							
x_4	-77	-42						
x_5	-7	-6	-2					
x_7	-11	-7	9	-1				
x_8	-17	-9	19	-1	2			
x_{11}	-1	-1	-1	0	0	0		
x_{21}	-5	19	-9	-1	-2	-2	0	
Γ	11	-9	-2	1	-40	0	0	-2
	x_1	x_2	x_4	x_5	x_7	x_8	x_{11}	x_{21}

Mode	Rate (MeV)		
Γ_1	$\pi^+\pi^-\eta$	0.0799 ± 0.0029	DESIG=1
Γ_2	$\rho^0\gamma(\text{including non-resonant})$ $\pi^+\pi^-\gamma$	0.0554 ± 0.0019	DESIG=9
Γ_4	$\pi^0\pi^0\eta$	0.0421 ± 0.0017	DESIG=2
Γ_5	$\omega\gamma$	0.00474 ± 0.00020	DESIG=7

Γ_7	$\gamma\gamma$	0.00434 \pm 0.00013	DESIG=6
Γ_8	$3\pi^0$	(4.7 \pm 0.4) $\times 10^{-4}$	DESIG=8
Γ_{11}	$\pi^+\pi^-\pi^0$	(6.8 \pm 0.4) $\times 10^{-4}$	DESIG=121
Γ_{21}	$\pi^+\pi^-e^+e^-$	(4.57 \pm 0.19) $\times 10^{-4}$	DESIG=10

 $\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

 $\Gamma(\gamma\gamma)$ **Γ_7**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.34\pm0.14 OUR FIT				
4.28\pm0.19 OUR AVERAGE				
4.17 \pm 0.10 \pm 0.27	2000	¹ ACCIARRI	98Q L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.53 \pm 0.29 \pm 0.51	266	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
3.61 \pm 0.13 \pm 0.48		² BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.6 \pm 1.1 \pm 0.6	23	BARU	90 MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.57 \pm 0.25 \pm 0.44		BUTLER	90 MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
5.08 \pm 0.24 \pm 0.71	547	³ ROE	90 ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 \pm 0.7 \pm 0.6	34	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 \pm 0.5 \pm 0.5	136	⁴ WILLIAMS	88 CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7 \pm 0.6 \pm 0.9	143	⁵ GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 \pm 0.9		⁶ BARTEL	85E JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

NODE=M002W4
NODE=M002W4¹No non-resonant $\pi^+\pi^-$ contribution found.²Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.³Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁴Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁵Superseded by BUTLER 90.⁶Systematic error not evaluated.NODE=M002W4;LINKAGE=AC
NODE=M002W4;LINKAGE=K1
NODE=M002W4;LINKAGE=K2
NODE=M002W4;LINKAGE=K3
NODE=M002W4;LINKAGE=C
NODE=M002W4;LINKAGE=A **$\Gamma(e^+e^-)$** **Γ_{28}**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.1 $\times 10^{-3}$	90	^{1,2} ACHASOV	15 SND	0.958 $e^+e^- \rightarrow \pi\pi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.0 $\times 10^{-3}$	90	² ACHASOV	15 SND	0.958 $e^+e^- \rightarrow \pi\pi\eta$
<2.4 $\times 10^{-3}$	90	² AKHMETSHIN	15 CMD3	0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$
¹ Combining data of ACHASOV 15 and AKHMETSHIN 15.				
² Using η and η' branching fractions from PDG 14.				

NODE=M002W1
NODE=M002W1

OCCUR=2

NODE=M002W1;LINKAGE=A
NODE=M002W1;LINKAGE=B **$\eta'(958) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$**

NODE=M002223

This combination of a partial width with the partial width into $\gamma\gamma$ and with the total width is obtained from the integrated cross section into channel(i) in the $\gamma\gamma$ annihilation.

NODE=M002223

 $\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$ **$\Gamma_7\Gamma_2/\Gamma$**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28\pm0.04 OUR FIT				
1.26\pm0.07 OUR AVERAGE				Error includes scale factor of 1.2.
1.09 \pm 0.04 \pm 0.13		BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
1.35 \pm 0.09 \pm 0.21		AIHARA	87 TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.13 \pm 0.04 \pm 0.13	867	ALBRECHT	87B ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.53 \pm 0.09 \pm 0.21		ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.14 \pm 0.08 \pm 0.11	243	BERGER	84B PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.73 \pm 0.34 \pm 0.35	95	JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.49 \pm 0.13 \pm 0.027	213	BARTEL	82B JADE	$e^+e^- \rightarrow e^+e^-\rho\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.85 \pm 0.31 \pm 0.24	43	BEHREND	82C CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$

NODE=M002G1
NODE=M002G1

$\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_4/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.97±0.04 OUR FIT	Error includes scale factor of 1.1.		
0.92±0.06±0.11	¹ KARCH	92	CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
• • •	We do not use the following data for averages, fits, limits, etc. • • •		
0.95±0.05±0.08	² KARCH	90	CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	^{2,3} ANTREASYAN	87	CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

NODE=M002G2
 NODE=M002G2

¹ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.

² Superseded by KARCH 92.

³ Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.

NODE=M002G2;LINKAGE=K4

NODE=M002G2;LINKAGE=A

NODE=M002G2;LINKAGE=D

 $\eta'(958) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M002224

 $\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{28}/\Gamma$

VALUE (10^{-3} eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AKHMETSHIN 15	CMD3	0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$
¹ AKHMETSHIN 15 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta) \times \Gamma(\eta'(958) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 4.1 \times 10^{-4}$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.				

NODE=M002G01
 NODE=M002G01

NODE=M002G01;LINKAGE=A

 $\eta'(958) \text{ BRANCHING RATIOS}$

NODE=M002230

 $\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
42.5 ± 0.5 OUR FIT	Error includes scale factor of 1.1.			
41.24±0.08±1.24	312k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$
• • •	We do not use the following data for averages, fits, limits, etc. • • •			
42.4 ± 1.1 ± 0.4	1.2k	¹ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$

NODE=M002R47
 NODE=M002R47

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R47;LINKAGE=PE

 $\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{\text{total}}$ $0.2805\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1191±0.0015 OUR FIT	Error includes scale factor of 1.1.			
• • •	We do not use the following data for averages, fits, limits, etc. • • •			
0.123 ± 0.014	107	RITTENBERG	69	HBC 1.7–2.7 K^-p
0.10 ± 0.04	10	LONDON	66	HBC 2.24 $K^-p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$
0.07 ± 0.04	7	BADIER	65B	HBC 3 K^-p

NODE=M002R3
 NODE=M002R3

 $\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$ $0.7195\Gamma_1/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.306±0.004 OUR FIT	Error includes scale factor of 1.1.			
• • •	We do not use the following data for averages, fits, limits, etc. • • •			
0.314±0.026	281	RITTENBERG	69	HBC 1.7–2.7 K^-p

NODE=M002R1
 NODE=M002R1

 $\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
29.5 ± 0.4 OUR FIT	Error includes scale factor of 1.1.			
29.90± 0.03±0.55	913k	ABLIKIM	19T	BES $J/\psi \rightarrow \gamma\eta'$
• • •	We do not use the following data for averages, fits, limits, etc. • • •			
28.7 ± 0.7 ± 0.4	0.2k	¹ PEDLAR	09	CLEO $J/\psi \rightarrow \gamma\eta'$
32.9 ± 3.3	298	RITTENBERG	69	HBC 1.7–2.7 K^-p
20 ± 10	20	LONDON	66	HBC 2.24 $K^-p \rightarrow \Lambda\pi^+\pi^-\gamma$
34 ± 9	35	BADIER	65B	HBC 3 K^-p

NODE=M002R6
 NODE=M002R6

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R6;LINKAGE=PE

 $\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
• • •	We do not use the following data for averages, fits, limits, etc. • • •			
33.34±0.06±1.60	970k	¹ ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$
34.43±0.52±1.97	970k	² ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$

NODE=M002R66
 NODE=M002R66

OCCUR=2

¹ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$, $\omega(782)$, and box anomaly components.

² From a fit to $\pi^+\pi^-$ mass using $\rho(770)$, $\omega(782)$, and $\rho(1450)$ components.

NODE=M002R66;LINKAGE=A

NODE=M002R66;LINKAGE=B

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi^+ \pi^- \eta) \quad \Gamma_2/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R43
NODE=M002R43

0.694 ± 0.014 OUR FIT Error includes scale factor of 1.1.

0.683 ± 0.020 OUR AVERAGE

0.677 ± 0.024 ± 0.011	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
0.69 ± 0.03	ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta' \gamma$

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi^+ \pi^- \eta (\text{neutral decay})) \quad \Gamma_2/0.714\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R27
NODE=M002R27
NEW

0.972 ± 0.019 OUR FIT Error includes scale factor of 1.1. [0.972 ± 0.020 OUR 2024 FIT
Scale factor = 1.1]

0.97 ± 0.09 OUR AVERAGE

0.70 ± 0.22		AMSLER	04B	CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \eta$
1.07 ± 0.17		BELADIDZE	92C	VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
0.92 ± 0.14	473	DANBURG	73	HBC	$2.2 K^- p \rightarrow \Lambda \chi^0$
1.11 ± 0.18	192	JACOBS	73	HBC	$2.9 K^- p \rightarrow \Lambda \chi^0$

$$\Gamma(\pi^0 \pi^0 \eta) / \Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R48
NODE=M002R48

22.4 ± 0.6 OUR FIT Error includes scale factor of 1.1.

21.36 ± 0.10 ± 0.92 52k ABLIKIM 19T BES $J/\psi \rightarrow \gamma \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

23.5 ± 1.3 ± 0.4 3.2k ¹ PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R48;LINKAGE=PE

$$\Gamma(\pi^0 \pi^0 \eta (3\pi^0 \text{ decay})) / \Gamma_{\text{total}} \quad 0.321\Gamma_4/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R26
NODE=M002R26

0.0718 ± 0.0018 OUR FIT Error includes scale factor of 1.1.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.11 ± 0.06 4 BENSINGER 70 DBC $2.2 \pi^+ d$

$$\Gamma(\pi^0 \pi^0 \eta) / \Gamma(\pi^+ \pi^- \eta) \quad \Gamma_4/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R45
NODE=M002R45

0.527 ± 0.019 OUR FIT Error includes scale factor of 1.1.

0.555 ± 0.043 ± 0.013 PEDLAR 09 CLE3 $J/\psi \rightarrow \eta' \gamma$

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi \pi \eta) \quad \Gamma_2/(\Gamma_1 + \Gamma_4)$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R7
NODE=M002R7
NEW

0.455 ± 0.008 OUR FIT Error includes scale factor of 1.1. [0.454 ± 0.009 OUR 2024 FIT
Scale factor = 1.1]

0.43 ± 0.02 ± 0.02 BARBERIS 98C OMEG 450 $p p \rightarrow p_f \eta' p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ± 0.15 DAVIS 68 HBC $5.5 K^- p$

$$\Gamma(\omega \gamma) / \Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R49
NODE=M002R49

2.52 ± 0.07 OUR FIT

2.50 ± 0.07 OUR AVERAGE

2.489 ± 0.018 ± 0.074 23k ABLIKIM 19T BES $J/\psi \rightarrow \gamma \eta'$

2.55 ± 0.03 ± 0.16 33.2k ¹ ABLIKIM 15AD BES3 $J/\psi \rightarrow \eta' \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.34 ± 0.30 ± 0.04 70 ² PEDLAR 09 CLEO $J/\psi \rightarrow \gamma \eta'$

¹ Using $B(J/\psi \rightarrow \eta' \gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

² Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R49;LINKAGE=A
NODE=M002R49;LINKAGE=PE

$$\Gamma(\omega \gamma) / \Gamma(\pi^+ \pi^- \eta) \quad \Gamma_5/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R17
NODE=M002R17

0.0593 ± 0.0018 OUR FIT Error includes scale factor of 1.1.

0.055 ± 0.007 ± 0.001 PEDLAR 09 CLE3 $J/\psi \rightarrow \eta' \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.068 ± 0.013 68 ZANFINO 77 ASPK $8.4 \pi^- p$

$$\Gamma(\omega \gamma) / \Gamma(\pi^0 \pi^0 \eta) \quad \Gamma_5/\Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R33
NODE=M002R33

0.113 ± 0.004 OUR FIT

0.147 ± 0.016 ALDE 87B GAM2 $38 \pi^- p \rightarrow n 4 \gamma$

$\Gamma(\omega e^+ e^-)/\Gamma(\omega\gamma)$ Γ_6/Γ_5

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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NODE=M002R60
NODE=M002R60

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.71 \pm 1.34 \pm 0.54$	¹ ABLIKIM	15AD BES3	$J/\psi \rightarrow \eta' \gamma$
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¹ Obtained from other ABLIKIM 15AD measurements with common systematics taken into account.

NODE=M002R60;LINKAGE=A

 $\Gamma(\omega e^+ e^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R59
NODE=M002R59

$1.97 \pm 0.34 \pm 0.17$	66	¹ ABLIKIM	15AD BES3	$J/\psi \rightarrow \eta' \gamma$
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¹ Using $B(J/\psi \rightarrow \eta' \gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M002R59;LINKAGE=A

$$\frac{\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / [\Gamma(\pi^+ \pi^- \eta) + \Gamma(\pi^0 \pi^0 \eta) + \Gamma(\omega \gamma)]}{\Gamma_2 / (\Gamma_1 + \Gamma_4 + \Gamma_5)}$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R18
NODE=M002R18

0.438 ± 0.008 OUR FIT Error includes scale factor of 1.1. [0.437 \pm 0.008 OUR 2024 FIT Scale factor = 1.1]

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.25 ± 0.14	DAUBER	64	HBC	1.95 $K^- p$
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$$[\Gamma(\pi^0 \pi^0 \eta (\text{charged decay})) + \Gamma(\omega (\text{charged decay}) \gamma)] / \Gamma_{\text{total}}$$
 $(0.286\Gamma_4 + 0.89\Gamma_5) / \Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R4
NODE=M002R4

0.0864 ± 0.0017 OUR FIT Error includes scale factor of 1.1.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.045 ± 0.029	42	RITTENBERG	69	HBC	1.7–2.7 $K^- p$
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 $\Gamma(\pi^+ \pi^- \text{ neutrals}) / \Gamma_{\text{total}}$ $(0.714\Gamma_1 + 0.286\Gamma_4 + 0.89\Gamma_5) / \Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R2
NODE=M002R2

0.3896 ± 0.0027 OUR FIT Error includes scale factor of 1.1. [0.3897 \pm 0.0028 OUR 2024 FIT Scale factor = 1.1]

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4 \pm 0.1	39	LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^-$ neutrals
0.35 \pm 0.06	33	BADIER	65B	HBC	3 $K^- p$

 $\Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M002R19
NODE=M002R19

2.307 ± 0.035 OUR FIT Error includes scale factor of 1.1.

2.31 ± 0.06 OUR AVERAGE Error includes scale factor of 1.8.

$2.331 \pm 0.012 \pm 0.035$	71k	ABLIKIM	19T	BES	$J/\psi \rightarrow \gamma \eta'$
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$1.99^{+0.31}_{-0.27} \pm 0.07$	114	¹ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
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2.00 ± 0.18		² STANTON	80	SPEC	$8.45 \pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.25 \pm 0.16 \pm 0.03$	0.3k	³ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
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1.8 ± 0.2	6000	⁴ APEL	79	NICE	$15-40 \pi^- p \rightarrow n 2\gamma$
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2.5 ± 0.7		DUANE	74	MMS	$\pi^- p \rightarrow n \text{MM}$
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1.71 ± 0.33	68	DALPIAZ	72	CNTR	$1.6 \pi^- p \rightarrow n X^0$
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$2.0^{+0.8}_{-0.6}$	31	HARVEY	71	OSPK	$3.65 \pi^- p \rightarrow n X^0$
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¹ WICHT 08 reports $[\Gamma(\eta'(958) \rightarrow \gamma\gamma) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta' K^+) = (7.04 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R19;LINKAGE=WI

² Includes APEL 79 result.

³ Not independent of other η' branching fractions and ratios in PEDLAR 09.

⁴ Data is included in STANTON 80 evaluation.

NODE=M002R19;LINKAGE=S
NODE=M002R19;LINKAGE=PE
NODE=M002R19;LINKAGE=A

 $\Gamma(\gamma\gamma) / \Gamma(\pi^+ \pi^- \eta)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M002R46
NODE=M002R46

0.0543 ± 0.0012 OUR FIT Error includes scale factor of 1.1.

$0.053 \pm 0.004 \pm 0.001$	PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
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$\Gamma(\gamma\gamma)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_7/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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0.0782±0.0016 OUR FIT Error includes scale factor of 1.1. [0.0783 ± 0.0016 OUR 2024 FIT Scale factor = 1.1]

NODE=M002R42
 NODE=M002R42
 NEW

0.080 ±0.008	ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta'\gamma$
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 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_7/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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0.1031±0.0028 OUR FIT

0.105 ±0.010 OUR AVERAGE Error includes scale factor of 1.9.

0.091 ±0.009	AMSLER	93	CBAR	0.0 $\bar{p}p$
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0.112 ±0.002 ±0.006	ALDE	87B	GAM2	38 $\pi^-p \rightarrow n2\gamma$
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NODE=M002R38
 NODE=M002R38

 $\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_7/0.714\Gamma_4$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.144±0.004 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.188±0.058	16	APEL	72	OSPK	3.8 $\pi^-p \rightarrow n\chi^0$
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NODE=M002R28
 NODE=M002R28

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_4+0.09\Gamma_5+\Gamma_7)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.185±0.004 OUR FIT Error includes scale factor of 1.1.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.185±0.022	535	BASILE	71	CNTR	1.6 $\pi^-p \rightarrow n\chi^0$
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0.189±0.026	123	RITTENBERG	69	HBC	1.7-2.7 K^-p
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NODE=M002R5
 NODE=M002R5

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.50 ±0.17 OUR FIT

3.57 ±0.26 OUR AVERAGE

3.522±0.082±0.254	2015	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$
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4.79 ±0.59 ±1.14	183	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+K^-3\pi$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.56 ±0.22 ±0.34	309	² ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$
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¹We have added all systematic uncertainties in quadrature to a single value.

²Superseded by ABLIKIM 17.

NODE=M002R55
 NODE=M002R55

NODE=M002R55;LINKAGE=A
 NODE=M002R55;LINKAGE=B

 $\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_8/Γ_4

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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112± 8 OUR FIT

78±10 OUR AVERAGE

86±19	235	BLIK	08	GAMS	32 $\pi^-p \rightarrow \eta'n$
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74±15		ALDE	87B	GAM2	38 $\pi^-p \rightarrow n6\gamma$
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75±18		BINON	84	GAM2	30-40 $\pi^-p \rightarrow n6\gamma$
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NODE=M002R32
 NODE=M002R32

 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_9/Γ_7

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.9±1.2

33

VIKTOROV	80	CNTR	25,33	$\pi^-p \rightarrow 2\mu\gamma$
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NODE=M002R29
 NODE=M002R29

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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2.13±0.13 OUR AVERAGE

[(1.9 ± 0.4) × 10⁻⁵ OUR 2024 AVERAGE]

2.15±0.13±0.02	434	¹ ABLIKIM	24AK	BES3	$J/\psi \rightarrow \gamma\eta'$
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1.94±0.37±0.02	53	² ABLIKIM	21I	BES3	$J/\psi \rightarrow \gamma\eta'(958)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.9	90	³ ABLIKIM	130	BES3	$J/\psi \rightarrow \gamma\eta'$
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<24	90	⁴ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$
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NODE=M002R50
 NODE=M002R50

NEW

¹ABLIKIM 24AK reports $(2.16 \pm 0.12 \pm 0.06) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²ABLIKIM 21i reports $(1.97 \pm 0.33 \pm 0.19) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.

⁴Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.

NODE=M002R50;LINKAGE=C

NODE=M002R50;LINKAGE=E

NODE=M002R50;LINKAGE=A
NODE=M002R50;LINKAGE=NA $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{10}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

NODE=M002R03
NODE=M002R03

¹NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R03;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{10}/Γ_2

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	ABLIKIM	130	BES3 $J/\psi \rightarrow \gamma\eta'$

NODE=M002R57
NODE=M002R57 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.61 \pm 0.18 OUR FIT				
3.61 \pm 0.18 OUR AVERAGE				
3.591 \pm 0.054 \pm 0.174	6067	ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
4.28 \pm 0.49 \pm 1.11	78	¹ ABLIKIM	15P	BES3 $J/\psi \rightarrow K^+K^-3\pi$
3.7 $^{+1.1}_{-0.9} \pm 0.4$		² NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

NODE=M002R21
NODE=M002R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.83 \pm 0.15 \pm 0.39 1014 ³ABLIKIM 12E BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$

¹We have added all systematic uncertainties in quadrature to a single value.

²Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.

³Superseded by ABLIKIM 17.

NODE=M002R21;LINKAGE=A
NODE=M002R21;LINKAGE=NA
NODE=M002R21;LINKAGE=B $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 \pm 0.4 OUR FIT				Error includes scale factor of 1.1.
8.27 $^{+2.49}_{-2.12} \pm 0.04$	20	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma\eta'$

NODE=M002R01
NODE=M002R01

¹NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21^{+6}_{-5} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R01;LINKAGE=NA

 $\Gamma((\pi^+\pi^-\pi^0) \text{ S-wave})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
37.63 \pm 0.77 \pm 5.00	6580	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$

NODE=M002R63
NODE=M002R63

¹We have added all systematic uncertainties in quadrature.

NODE=M002R63;LINKAGE=A

 $\Gamma(\pi^\mp\rho^\pm)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.44 \pm 0.60 \pm 2.23	1231	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma(\pi^\mp\rho^\pm)$

NODE=M002R62
NODE=M002R62

¹We have added all systematic uncertainties in quadrature.

NODE=M002R62;LINKAGE=A

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.51 \pm 0.33 OUR AVERAGE					$[(8.3 \pm 0.9) \times 10^{-5}]$ OUR 2024 AVERAGE]
8.51 \pm 0.32 \pm 0.10	1650	¹ ABLIKIM	24F	BES3	$J/\psi \rightarrow \gamma\eta'(958)$

NODE=M002R24
NODE=M002R24

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.3 \pm 0.9 \pm 0.1 199 ^{2,3}ABLIKIM 14M BES3 $J/\psi \rightarrow \gamma\eta'$
 < 24 90 ⁴NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$
 < 1000 90 RITTENBERG 69 HBC 1.7–2.7 K^-p

¹ ABLIKIM 24F reports $(8.56 \pm 0.25 \pm 0.23) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ = $(4.40 \pm 0.35 \pm 0.30) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by ABLIKIM 24F.

⁴ Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.

NODE=M002R24;LINKAGE=B

NODE=M002R24;LINKAGE=A

NODE=M002R24;LINKAGE=C

NODE=M002R24;LINKAGE=NA

$\Gamma(2(\pi^+ \pi^-))/\Gamma(\pi^+ \pi^- \eta)$

Γ_{14}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

NODE=M002R04
NODE=M002R04

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+ \pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)] < 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R04;LINKAGE=NA

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$

Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.11±0.15 OUR AVERAGE			[(1.8 ± 0.4) × 10 ⁻⁴ OUR 2024 AVERAGE]		
2.11±0.15±0.02	865		¹ ABLIKIM	24F	BES3 $J/\psi \rightarrow \gamma \eta'(958)$

NODE=M002R51
NODE=M002R51

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.78±0.38±0.02	84	^{2,3} ABLIKIM	14M	BES3	$J/\psi \rightarrow \gamma \eta'$
<27	90	⁴ NAIK	09	CLEO	$J/\psi \rightarrow \gamma \eta'$

¹ ABLIKIM 24F reports $(2.12 \pm 0.12 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R51;LINKAGE=B

² ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ = $(9.38 \pm 1.79 \pm 0.89) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R51;LINKAGE=A

³ Superseded by ABLIKIM 24F.

⁴ Not independent of measured value of Γ_{15}/Γ_1 from NAIK 09.

NODE=M002R51;LINKAGE=C

NODE=M002R51;LINKAGE=NA

$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi^+ \pi^- \eta)$

Γ_{15}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

NODE=M002R05
NODE=M002R05

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- 2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R05;LINKAGE=NA

$\Gamma(2(\pi^+ \pi^-) \text{ neutrals})/\Gamma_{\text{total}}$

Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	DANBURG	73	HBC $2.2 K^- p \rightarrow \Lambda X^0$

NODE=M002R22
NODE=M002R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.01	90	RITTENBERG	69	HBC $1.7-2.7 K^- p$
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$\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$

Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.002	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$
<0.01	90	RITTENBERG	69	HBC $1.7-2.7 K^- p$

NODE=M002R23
NODE=M002R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.

NODE=M002R23;LINKAGE=NA

$\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma(\pi^+ \pi^- \eta)$

Γ_{17}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

NODE=M002R06
NODE=M002R06

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+ \pi^-) \pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)] < 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R06;LINKAGE=NA

$\Gamma(2(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)+MM$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<0.01	90	LONDON	66	HBC Compilation

NODE=M002R16
 NODE=M002R16

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	¹ ABLIKIM	13U	BES3 $J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 53	90	² NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$
<500	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+\pi^-)$

NODE=M002R07
 NODE=M002R07

¹ Using $B(J/\psi \rightarrow \gamma \eta'(958)) = (5.16 \pm 0.15) \times 10^{-3}$.

² Not independent of measured value of Γ_{19}/Γ_1 from NAIK 09.

NODE=M002R07;LINKAGE=A
 NODE=M002R07;LINKAGE=NA

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-)$ Γ_{19}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ NAIK	09	CLEO $J/\psi \rightarrow \gamma \eta'$

NODE=M002R08
 NODE=M002R08

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)] / [B(\eta \rightarrow 2\gamma)] < 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R08;LINKAGE=NA

 $\Gamma(K^\pm \pi^\mp)/\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{20}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 $\times 10^{-4}$	90	ABLIKIM	16M	BES3 $e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

NODE=M002R61
 NODE=M002R61

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.43 ± 0.06 OUR FIT					

NODE=M002R12
 NODE=M002R12

[(2.42 ± 0.10) $\times 10^{-3}$ OUR 2024 FIT]

2.44 ± 0.08 ± 0.03 22725 ¹ ABLIKIM 24AK BES3 $J/\psi \rightarrow \gamma \eta'$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

2.11 ± 0.12 ± 0.14 429 ² ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma \eta'$

2.5 $^{+1.2}_{-0.9} \pm 0.5$ ³ NAIK 09 CLEO $J/\psi \rightarrow \gamma \eta'$

<6 90 RITTENBERG 65 HBC 2.7 $K^- p$

NEW

¹ ABLIKIM 24AK reports $(2.45 \pm 0.02 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R12;LINKAGE=C

² Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.

NODE=M002R12;LINKAGE=A
 NODE=M002R12;LINKAGE=NA

³ Not independent of measured value of Γ_{21}/Γ_1 from NAIK 09.

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-)$ Γ_{21}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.72 ± 0.17 OUR FIT				

NODE=M002R02
 NODE=M002R02

[(5.69 ± 0.25) $\times 10^{-3}$ OUR 2024 FIT]

5.51 $^{+3.00}_{-2.29} \pm 0.03$ 8 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma \eta'$

NEW

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)] / [B(\eta \rightarrow 2\gamma)] = (14 $^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.$

NODE=M002R02;LINKAGE=NA

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{21}/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.24 ± 0.21 OUR FIT				

NODE=M002R56
 NODE=M002R56

[(8.20 ± 0.31) $\times 10^{-3}$ OUR 2024 FIT]

8.20 ± 0.16 ± 0.27 2584 ABLIKIM 21J BES3 $J/\psi \rightarrow \gamma \eta'$

NEW

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

7.2 ± 0.4 ± 0.5 429 ¹ ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma \eta'$

¹ Superseded by ABLIKIM 21J.

NODE=M002R56;LINKAGE=A

$\Gamma(\pi^+ e^- \nu_e + \text{c.c.})/\Gamma(\pi^+ \pi^- \eta)$ Γ_{22}/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	ABLIKIM	13G BES3	$J/\psi \rightarrow \phi \eta'$

NODE=M002R54
 NODE=M002R54

 $\Gamma(\gamma e^+ e^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.80±0.14±0.05	7611		¹ ABLIKIM	24M BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta'$

NODE=M002R40
 NODE=M002R40

• • • We do not use the following data for averages, fits, limits, etc. • • •

<9	90	BRIERE	00 CLEO	10.6 $e^+ e^-$
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OCCUR=2

¹ ABLIKIM 24M reports $(4.83 \pm 0.07 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \gamma e^+ e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R40;LINKAGE=H

 $\Gamma(\gamma e^+ e^-)/\Gamma(\gamma\gamma)$ Γ_{23}/Γ_7

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.13±0.09±0.07	864	ABLIKIM	150 BES3	$J/\psi \rightarrow \gamma e^+ e^-$

NODE=M002R00
 NODE=M002R00

 $\Gamma(\pi^0 \gamma\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.20±0.07±0.23	3.4k	ABLIKIM	17T BES3	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R64
 NODE=M002R64

 $\Gamma(\pi^0 \gamma\gamma)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{24}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<37	90	ALDE	87B GAM2	$38 \pi^- p \rightarrow n 4\gamma$

NODE=M002R35
 NODE=M002R35

 $\Gamma(\pi^0 \gamma\gamma (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.16±0.64±0.67	655	ABLIKIM	17T BES3	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R65
 NODE=M002R65

 $\Gamma(\eta\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.33 × 10⁻⁴	90	ABLIKIM	19AW BES3	$J/\psi \rightarrow \gamma \eta' \rightarrow \gamma \gamma \gamma 2\gamma$

NODE=M002R67
 NODE=M002R67

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2 × 10⁻⁵ (CL = 90%)		[<4.94 × 10 ⁻⁵ (CL = 90%) OUR 2024 BEST LIMIT]		

NODE=M002R58
 NODE=M002R58

<1.2 × 10 ⁻⁵	90	¹ ABLIKIM	24F BES3	$J/\psi \rightarrow \gamma \eta'(958)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.94 × 10 ⁻⁵	90	² ABLIKIM	20E BES3	$J/\psi \rightarrow \eta' \gamma$
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<3.2 × 10 ⁻⁴	90	DONSKOV	14 GAM4	32.5 $\pi^- p \rightarrow \eta' n$
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¹ ABLIKIM 24F reports $< 1.24 \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.28 \times 10^{-3}$.

² Superseded by ABLIKIM 24F.

NODE=M002R58;LINKAGE=A

NODE=M002R58;LINKAGE=B

 $\Gamma(4\pi^0)/\Gamma(\pi^0 \pi^0 \eta)$ Γ_{27}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<23	90	ALDE	87B GAM2	$38 \pi^- p \rightarrow n 8\gamma$

NODE=M002R37
 NODE=M002R37

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6 × 10⁻⁹	90	¹ ACHASOV	15 SND	0.958 $e^+ e^- \rightarrow \pi \pi \eta$

NODE=M002R39
 NODE=M002R39

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12 × 10 ⁻⁹	90	² AKHMETSHIN	15 CMD3	0.958 $e^+ e^- \rightarrow \pi^+ \pi^- \eta$
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< 2.1 × 10 ⁻⁷	90	VOROBYEV	88 ND	$e^+ e^- \rightarrow \pi^+ \pi^- \eta$
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¹ Combining data of ACHASOV 15 and AKHMETSHIN 15 and using $\Gamma(\eta') = 0.198 \pm 0.009$ MeV.

² Using $\Gamma_{\eta'(958)} = 198 \pm 9$ keV, $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (42.9 \pm 0.7)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$.

NODE=M002R39;LINKAGE=B

NODE=M002R39;LINKAGE=A

$\Gamma(e^+e^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.1 \pm 0.1$	30	¹ ABLIKIM	22E BES3	$J/\psi \rightarrow \gamma\eta'$

NODE=M002R68
 NODE=M002R68

¹ ABLIKIM 22E reports $(4.5 \pm 1.0 \pm 0.5) \times 10^{-6}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow e^+e^-e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R68;LINKAGE=B

 $\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\mu^+\mu^-)$ Γ_{21}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$113.4 \pm 0.9 \pm 3.7$	434	¹ ABLIKIM	24AK BES3	$J/\psi \rightarrow \gamma\eta'$

NODE=M002R70
 NODE=M002R70

• • • We do not use the following data for averages, fits, limits, etc. • • •

$113.4 \pm 0.9 \pm 3.7$ 434 ¹ ABLIKIM 24AK BES3 $J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 24AK value is not independent from the individual branching fraction measurements.

NODE=M002R70;LINKAGE=A

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.1 \times 10^{-4}$	90	¹ ANDREEV	24D NA64	$CEX \pi^- Fe \rightarrow \eta' X$

NODE=M002R52
 NODE=M002R52

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 9.5 \times 10^{-4}$ 90 ² NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ ANDREEV 24D result is based on 2.9×10^9 pions on active ^{26}Fe target.

² Not independent of measured value of Γ_{30}/Γ_1 from NAIK 09.

NODE=M002R52;LINKAGE=A
 NODE=M002R52;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ Γ_{30}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

NODE=M002R09
 NODE=M002R09

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.1 90 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R09;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{30}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.4 \times 10^{-2}$	90	ABLIKIM	13 BES3	$J/\psi \rightarrow \phi\eta'$
$< 6.69 \times 10^{-2}$	90	ABLIKIM	06Q BES	$J/\psi \rightarrow \phi\eta'$

NODE=M002R44
 NODE=M002R44

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 2.4 \times 10^{-2}$ 90 ABLIKIM 13 BES3 $J/\psi \rightarrow \phi\eta'$

$< 6.69 \times 10^{-2}$ 90 ABLIKIM 06Q BES $J/\psi \rightarrow \phi\eta'$

 $\Gamma(\gamma \text{ Dark Photon})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.5 to 3.5	90	7611	¹ ABLIKIM	24M BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta'$

NODE=M002R72
 NODE=M002R72

¹ For a dark photon decaying to e^+e^- in the mass range 0 to 0.7 GeV.

NODE=M002R72;LINKAGE=A

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.18	90	¹ AAIJ	17D LHCB	$D_{(s)}^+ \rightarrow \pi^+\pi^-\pi^+$

NODE=M002R20
 NODE=M002R20

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.5 90 ² ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-$

< 29 90 ³ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$

< 3.3 90 ⁴ MORI 07A BELL $\gamma\gamma \rightarrow \pi^+\pi^-$

< 800 95 DANBURG 73 HBC $2.2 K^- p \rightarrow \Lambda X^0$

< 200 90 RITTENBERG 69 HBC $1.7-2.7 K^- p$

OCCUR=2

¹ Using branching fractions of $D_{(s)}^+$ decays from PDG 15.

² ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

³ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

⁴ Without interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

NODE=M002R20;LINKAGE=A
 NODE=M002R20;LINKAGE=AL

NODE=M002R20;LINKAGE=MO
 NODE=M002R20;LINKAGE=MR

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4 \times 10^{-4}$	90	¹ ABLIKIM	11G BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

NODE=M002R53
 NODE=M002R53

¹ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

NODE=M002R53;LINKAGE=AL

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{33}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<45	90	ALDE	87B	GAM2 38 $\pi^- p \rightarrow n4\gamma$

NODE=M002R36
NODE=M002R36 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	90	BRIERE	00	CLEO 10.6 $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<13	90	RITTENBERG	65	HBC 2.7 $K^- p$

NODE=M002R8
NODE=M002R8 $\Gamma(\pi^0\rho^0)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	RITTENBERG	65	HBC 2.7 $K^- p$

NODE=M002R10
NODE=M002R10 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	BRIERE	00	CLEO 10.6 $e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11	90	RITTENBERG	65	HBC 2.7 $K^- p$

NODE=M002R9
NODE=M002R9 $\Gamma(3\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{37}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	ALDE	87B	GAM2 38 $\pi^- p \rightarrow n3\gamma$

NODE=M002R34
NODE=M002R34 $\Gamma(\mu^+\mu^-\pi^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	90	DZHELADIN	81	CNTR 30 $\pi^- p \rightarrow \eta' n$

NODE=M002R31
NODE=M002R31 $\Gamma(\mu^+\mu^-\eta)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	DZHELADIN	81	CNTR 30 $\pi^- p \rightarrow \eta' n$

NODE=M002R30
NODE=M002R30 $\Gamma(e\mu)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.7	90	BRIERE	00	CLEO 10.6 $e^+ e^-$

NODE=M002R41
NODE=M002R41 $\Gamma(\pi^+\pi^-\text{ALP} \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-e^+e^-)$ Γ_{41}/Γ_{21}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.8 $\times 10^{-3}$	90	¹ ABLIKIM	24AK	BES3 $J/\psi \rightarrow \gamma\eta'$

NODE=M002R73
NODE=M002R73

¹ For a pseudoscalar ALP, with a mass in the range 0–500 MeV. The measured limit at the 90% credibility level as a function of the mass of ALP ranges from 0.1×10^{-3} to 7.8×10^{-3} .

NODE=M002R73;LINKAGE=A

 $\eta'(958) \rightarrow \eta\pi\pi$ DECAY PARAMETERS

NODE=M002225

$$|\text{MATRIX ELEMENT}|^2 = |1 + \alpha Y|^2 + CX + DX^2$$

X and Y are Dalitz variables; α is complex and C , and D are real-valued. Parameters C and D are not necessarily equal to c and d , respectively, in the generalized parameterization following this one. May be different for $\eta'(958) \rightarrow \eta\pi^+\pi^-$ and $\eta'(958) \rightarrow \eta\pi^0\pi^0$ decays. Because of different initial assumptions and strong correlations of the parameters we do not average the parameters in the section below.

NODE=M002225

 $\text{Re}(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.034 \pm 0.002 \pm 0.002$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^+\pi^-$
$-0.054 \pm 0.004 \pm 0.001$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta\pi^0\pi^0$
$-0.033 \pm 0.005 \pm 0.003$	44k	¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	² AMELIN	05A	VES 28 $\pi^- A \rightarrow \eta\pi^+\pi^-\pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	³ BRIERE	00	CLEO 10.6 $e^+ e^- \rightarrow \eta\pi^+\pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	⁴ ALDE	86	GAM2 38 $\pi^- p \rightarrow n\eta\pi^0\pi^0$
-0.08 ± 0.03		^{4,5} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta\pi^+\pi^-$

NODE=M002A0
NODE=M002A0

OCCUR=2

- ¹ See ABLIKIM 11 for the full correlation matrix.
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.
³ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.
⁴ Assuming $C = 0$.
⁵ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002A0;LINKAGE=AB
 NODE=M002A0;LINKAGE=AM
 NODE=M002A0;LINKAGE=BR
 NODE=M002A0;LINKAGE=A
 NODE=M002A0;LINKAGE=KA

$\text{Im}(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.000 \pm 0.019 \pm 0.001$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.000 \pm 0.038 \pm 0.002$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$0.000 \pm 0.049 \pm 0.001$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0.0 ± 0.3		^{3,4} KALBFLEISCH 74	RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002IA0
 NODE=M002IA0

OCCUR=2

- ¹ See ABLIKIM 11 for the full correlation matrix.
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.
³ Assuming $C = 0$.
⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002IA0;LINKAGE=AB
 NODE=M002IA0;LINKAGE=AM
 NODE=M002IA0;LINKAGE=A
 NODE=M002IA0;LINKAGE=KA

C decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.0027 \pm 0.0024 \pm 0.0015$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.018 \pm 0.009 \pm 0.003$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$

NODE=M002C0
 NODE=M002C0

- ¹ See ABLIKIM 11 for the full correlation matrix.
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

NODE=M002C0;LINKAGE=AB
 NODE=M002C0;LINKAGE=AM

D decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.053 \pm 0.004 \pm 0.004$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.061 \pm 0.009 \pm 0.005$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.059 \pm 0.012 \pm 0.004$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{3,4} KALBFLEISCH 74	RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002D0
 NODE=M002D0

- ¹ See ABLIKIM 11 for the full correlation matrix.
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.
³ Assuming $C = 0$.
⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002D0;LINKAGE=AB
 NODE=M002D0;LINKAGE=AM
 NODE=M002D0;LINKAGE=AL
 NODE=M002D0;LINKAGE=KA

$\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS

NODE=M002227

$$|\text{MATRIX ELEMENT}|^2 \propto 1 + a Y + b Y^2 + c X + d X^2$$

X and Y are Dalitz variables and a, b, c, and d are real-valued parameters. May be different for $\eta'(958) \rightarrow \eta \pi^+ \pi^-$ and $\eta'(958) \rightarrow \eta \pi^0 \pi^0$ decays. We do not average measurements in the section below because parameter values from each experiment are strongly correlated.

NODE=M002227

a decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.077 \pm 0.003 \pm 0.001$		¹ ABLIKIM	23AH BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.056 \pm 0.004 \pm 0.002$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002DPA
 NODE=M002DPA

$-0.087 \pm 0.009 \pm 0.006$	56k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.074 \pm 0.008 \pm 0.006$	124k	ADLARSON	18A	A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.072 \pm 0.007 \pm 0.008$		² GONZALEZ-S...	18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	³ ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	⁴ BLIK	09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	⁵ DOROFEEV	07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

OCCUR=2

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPA;LINKAGE=B
NODE=M002DPA;LINKAGE=A

NODE=M002DPA;LINKAGE=AB
NODE=M002DPA;LINKAGE=BL
NODE=M002DPA;LINKAGE=DO

NODE=M002DPB
NODE=M002DPB

b decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$-0.066 \pm 0.006 \pm 0.001$		¹ ABLIKIM	23AH	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.049 \pm 0.006 \pm 0.006$	351k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.073 \pm 0.014 \pm 0.005$	56k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.014 \pm 0.005$	124k	ADLARSON	18A	A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.052 \pm 0.001 \pm 0.002$		² GONZALEZ-S...	18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	³ ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	⁴ BLIK	09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	⁵ DOROFEEV	07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

OCCUR=2

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPB;LINKAGE=B
NODE=M002DPB;LINKAGE=A

NODE=M002DPB;LINKAGE=AB
NODE=M002DPB;LINKAGE=BL
NODE=M002DPB;LINKAGE=DO

NODE=M002DPC
NODE=M002DPC

c decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.0027 \pm 0.0024 \pm 0.0018$	351k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.019 \pm 0.011 \pm 0.003$	44k	¹ ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	² BLIK	09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³ DOROFEEV	07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ See ABLIKIM 11 for the full correlation matrix.

² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPC;LINKAGE=AB
NODE=M002DPC;LINKAGE=BL
NODE=M002DPC;LINKAGE=DO

d decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$-0.068 \pm 0.004 \pm 0.001$		¹ ABLIKIM	23AH	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.004 \pm 0.003$	351k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.074 \pm 0.009 \pm 0.004$	56k	ABLIKIM	18	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.050 \pm 0.009 \pm 0.005$	124k	ADLARSON	18A	A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.051 \pm 0.008 \pm 0.006$		² GONZALEZ-S...	18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	³ ABLIKIM	11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	⁴ BLIK	09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	⁵ DOROFEEV	07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

OCCUR=2

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPD;LINKAGE=B
NODE=M002DPD;LINKAGE=A

NODE=M002DPD;LINKAGE=AB
NODE=M002DPD;LINKAGE=BL

NODE=M002DPD;LINKAGE=DO

$\eta'(958)$ β PARAMETER

$|\text{MATRIX ELEMENT}|^2 = (1 + 2\beta Z)$

See the "Note on η Decay Parameters" in our 1994 edition Physical Review D50 1173 (1994), p. 1454.

β decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.61 ± 0.08 OUR AVERAGE		Error includes scale factor of 1.2.		
-0.640 ± 0.046 ± 0.047	1.8k	ABLIKIM	15G BES3	$J/\psi \rightarrow \gamma(\pi^0 \pi^0 \pi^0)$
-0.59 ± 0.18	235	BLIK	08 GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE	87B GAM2	$38 \pi^- p \rightarrow n 3\pi^0$

NODE=M002226

NODE=M002226

NODE=M002B0
NODE=M002B0

$\eta'(958)$ C-NONCONSERVING DECAY PARAMETER

See the note on η decay parameters in the Stable Particle Particle Listings for definition of this parameter.

NODE=M002235

NODE=M002235

DECAY ASYMMETRY PARAMETER FOR $\pi^+ \pi^- \gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-0.03 ± 0.04 OUR AVERAGE				
-0.019 ± 0.056		AIHARA 87	TPC	$2\gamma \rightarrow \pi^+ \pi^- \gamma$
-0.069 ± 0.078	295	GRIGORIAN 75	STRC	$2.1 \pi^- p$
0.00 ± 0.10	103	KALBFLEISCH 75	HBC	$2.18 K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.07 ± 0.08	152	RITTENBERG 65	HBC	$2.1-2.7 K^- p$

NODE=M002A
NODE=M002A

$\eta'(958) \rightarrow \gamma \ell^+ \ell^-$ TRANSITION FORM FACTOR SLOPE

Related to the effective virtual meson mass Λ , via slope $\approx \Lambda^{-2}$. See e.g. LANDSBERG 85, eq. (3.8), for a detailed definition.

VALUE (GeV ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.53 ± 0.04 OUR AVERAGE				
[1.62 ± 0.17 GeV ⁻² OUR 2024 AVERAGE]				
1.524 ± 0.041	7611	¹ ABLIKIM	24M BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta'$
1.7 ± 0.4	33	¹ VIKTOROV	80	$25,33 \pi^- p \rightarrow 2\mu\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.30 ± 0.19		² ABLIKIM	24AK BES3	$\eta' \rightarrow \pi^+ \pi^- \mu^+ \mu^-$,
				$\pi^+ \pi^- e^+ e^-$
1.60 ± 0.17 ± 0.08	864	¹ ABLIKIM	150 BES3	$\eta' \rightarrow \gamma e^+ e^-$

NODE=M002FFL

NODE=M002FFL

NODE=M002FFL

NEW

¹ In the single-pole Ansatz where slope = $1/(\Lambda^2 + \gamma^2)$ with Λ , γ being a Breit-Wigner mass, width for the effective contributing vector meson.

² From a weighted average of the $\eta' \rightarrow \pi^+ \pi^- e^+ e^-$ and $\eta' \rightarrow \pi^+ \pi^- \mu^+ \mu^-$ values. The uncertainty is obtained by combining statistical and systematic uncertainties.

TFF slope values go between $1.10 \pm 0.21 \text{ GeV}^{-2}$ and $1.61 \pm 0.71 \text{ GeV}^{-2}$ for $\eta' \rightarrow \pi^+ \pi^- e^+ e^-$, and between $2.37 \pm 0.49 \text{ GeV}^{-2}$ and $2.88 \pm 0.25 \text{ GeV}^{-2}$ for $\eta' \rightarrow \pi^+ \pi^- \mu^+ \mu^-$, according to the solution of the fitting function model.

NODE=M002FFL;LINKAGE=A

NODE=M002FFL;LINKAGE=B

$\eta'(958)$ REFERENCES

ABLIKIM	24AK	JHEP 2407 135	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62692
ABLIKIM	24F	PR D109 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62656
ABLIKIM	24M	PR D109 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62663
ANDREEV	24D	PRL 133 121803	Yu.M. Andreev <i>et al.</i>	(NA64 Collab.)	REFID=63013
ABLIKIM	23AH	PRL 130 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62206
ABLIKIM	22E	PR D105 112010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61639
ABLIKIM	21I	PR D103 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61112
ABLIKIM	21J	PR D103 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61114
ABLIKIM	20E	PR D101 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60252
ABLIKIM	19AW	PR D100 052015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60000
ABLIKIM	19T	PRL 122 142002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59773
ABLIKIM	18	PR D97 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58711
ABLIKIM	18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ADLARSON	18A	PR D98 012001	P. Adlarson <i>et al.</i>	(A2 Collab. at MAMI)	REFID=58957
GONZALEZ-S...	18A	EPJ C78 758	S. Gonzalez-Solis, E. Passemar	(BEIJ, IND+)	REFID=59316
AAJ	17D	PL B764 233	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57702
ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57650
ABLIKIM	17T	PR D96 012005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58013
ABLIKIM	16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57511
ABLIKIM	15AD	PR D92 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56983
ABLIKIM	15G	PR D92 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56602
ABLIKIM	15O	PR D92 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56780
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
ACHASOV	15	PR D91 092010	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=56788
AKHMETSHIN	15	PL B740 273	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	REFID=56386
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=5

NODE=M002

ABLIKIM	14M	PRL 112 251801	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55904
DONSKOV	14	MPL A29 1450213	S. Donskov <i>et al.</i>	(GAMS-4 π Collab.)	REFID=56321
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ABLIKIM	13	PR D87 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54829
ABLIKIM	13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54952
ABLIKIM	13O	PR D87 092011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55388
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55582
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53646
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53711
CZERWINSKI	10	PRL 105 122001	E. Czerwinski <i>et al.</i>	(COSY-11 Collab.)	REFID=53364
BLIK	09	PAN 72 231	A.M. Blik <i>et al.</i>	(IHEP (Protvino))	REFID=52727
Translated from YAF 72 258.					
NAIK	09	PRL 102 061801	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52678
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
BLIK	08	PAN 71 2124	A. Blik <i>et al.</i>	(GAMS-4 π Collab.)	REFID=52663
Translated from YAF 71 2161.					
LIBBY	08	PRL 101 182002	J. Libby <i>et al.</i>	(CLEO Collab.)	REFID=52591
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
DOROFEEV	07	PL B651 22	V. Dorofeev <i>et al.</i>	(VES Collab.)	REFID=51711
MORI	07A	JPSJ 76 074102	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51691
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06Q	PRL 97 202002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51487
AMELIN	05A	PAN 68 372	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=50766
Translated from YAF 68 401.					
AMSLER	04B	EPJ C33 23	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51079
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
BRIERE	00	PRL 84 26	R. Briere <i>et al.</i>	(CLEO Collab.)	REFID=47410
ACCIARRI	98Q	PL B418 399	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46316
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
WURZINGER	96	PL B374 283	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=44992
PDG	94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)	REFID=43653
AMSLER	93	ZPHY C58 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43311
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)	REFID=43175
Translated from YAF 55 2748.					
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=42170
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BEHREND	91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41497
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
KARCH	90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=41377
ROE	90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)	REFID=41014
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40564
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
Translated from YAF 48 436.					
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)	REFID=40567
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40009
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40265
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)	REFID=40236
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=40008
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=20310
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=10843
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)	REFID=10844
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)	REFID=20306
BINON	84	PL 140B 264	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP+)	REFID=20307
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BARTEL	82B	PL 113B 190	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=20300
BEHREND	82C	PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
Also					
		PL 125B 518 (err.)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
DZHELADIN	81	PL 105B 239	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=10836
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)	REFID=40294
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=20298
Translated from YAF 32 1005.					
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)	REFID=20295
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)	REFID=20296
ZANFINO	77	PRL 38 930	C. Zanfino <i>et al.</i>	(CARL, MCGI, OHIO+)	REFID=20293
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)	REFID=20287
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)	REFID=20284
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)	REFID=20286
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP	REFID=20280
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+) JP	REFID=20281
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20275
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i>	(CERN)	REFID=20278
BASILE	71	NC 3A 371	M. Basile <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20270
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i>	(MINN, MICH)	REFID=20272
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=20268
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I	REFID=20266
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i>	(NWES, ANL)	REFID=20263
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) JP	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SAFL, AMST)	REFID=20253
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)	REFID=10761
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i>	(UCLA) JP	REFID=20247
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP	REFID=20252

$f_0(980)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the related review(s):
 Scalar Mesons below 1 GeV

NODE=M003

 $f_0(980)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(980-1010) - i (20-35) OUR ESTIMATE (see Fig. 64.4 in the review)			
$(1002 \pm 9) - i(23 \pm 8)$	¹ HOFERICH... 24	RVUE	Compilation
$(993 \pm 2^{+2}_{-1}) - i(21 \pm 3^{+2}_{-4})$	² DANILKIN 21	RVUE	Compilation
$(1014 \pm 8) - i(35 \pm 5)$	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(992.8 \pm 1.3) - i(30.7 \pm 2.3)$	³ ALBRECHT 20	RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta\eta, \pi^0 K^+ K^-$
$(1003^{+5}_{-27}) - i(21^{+10}_{-8})$	⁴ GARCIA-MAR..11	RVUE	Compilation
$(996 \pm 7) - i(25^{+10}_{-6})$	⁵ GARCIA-MAR..11	RVUE	Compilation
$(996^{+4}_{-14}) - i(24^{+11}_{-3})$	⁶ MOUSSALLAM11	RVUE	Compilation
$(981 \pm 43) - i(18 \pm 11)$	⁷ MENNESSIER 10	RVUE	Compilation
$(1030^{+30}_{-10}) - i(35^{+10}_{-16})$	⁸ ANISOVICH 09	RVUE	$0.0 \bar{p}p, \pi N$
$(973^{+39}_{-127}) - i(11^{+189}_{-11})$	⁹ PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$

NODE=M003PP

NODE=M003PP

NODE=M003PP

→ UNCHECKED ←

OCCUR=2

¹ Using the GKPY equations as GARCIA-MARTIN 11, but with different treatment of kaon thresholds and input for $\pi\pi/K\bar{K}$ T-matrix from HOFERICHTER 16.

² Data driven analysis using partial-wave dispersion relations.

³ 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$). Based on 18.5k events. Second solution 977.8 ± 1.7 MeV.

⁴ Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73 using Roy equations.

⁵ Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73 using GKPY equations.

⁶ Uses Roy equations.

⁷ Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.

⁸ On sheet II in a 2-pole solution. The other pole is found on sheet III at $(850 - i 100)$ MeV.

⁹ Reanalysis of data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.

NODE=M003PP;LINKAGE=J

NODE=M003PP;LINKAGE=I

NODE=M003PP;LINKAGE=D

NODE=M003PP;LINKAGE=B

NODE=M003PP;LINKAGE=C

NODE=M003PP;LINKAGE=F

NODE=M003PP;LINKAGE=G

NODE=M003PP;LINKAGE=H

NODE=M003PP;LINKAGE=A

 $f_0(980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
990 ± 20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$992.0^{+8.5}_{-7.5} \pm 8.6$		¹ AAIJ 19H	LHCB	$pp \rightarrow D^\pm X$
989.4 ± 1.3	424	ABLIKIM 15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
989.9 ± 0.4	706	ABLIKIM 12E	BES3	$J/\psi \rightarrow \gamma 3\pi$
$977^{+11}_{-9} \pm 1$	44	² ECKLUND 09	CLEO	$4.17 e^+ e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
$982.2 \pm 1.0^{+8.1}_{-8.0}$		³ UEHARA 08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
$976.8 \pm 0.3^{+10.1}_{-0.6}$	64k	⁴ AMBROSINO 07	KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$984.7 \pm 0.4^{+2.4}_{-3.7}$	64k	⁵ AMBROSINO 07	KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
973 ± 3	262 ± 30	⁶ AUBERT 07AK	BABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$
970 ± 7	54 ± 9	⁶ AUBERT 07AK	BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \pi^0 \gamma$
953 ± 20	2.6k	⁷ BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$985.6^{+1.2+1.1}_{-1.5-1.6}$		⁸ MORI 07	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$983.0 \pm 0.6^{+4.0}_{-3.0}$		⁹ AMBROSINO 06B	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

NODE=M003M1

NODE=M003M1

→ UNCHECKED ←

OCCUR=2

OCCUR=2

977.3 ± 0.9 ^{+3.7} _{-4.3}		10	AMBROSINO	06B	KLOE	1.02 e ⁺ e ⁻ → π ⁺ π ⁻ γ	OCCUR=2
950 ± 9	2426	11	GARMASH	06	BELL	B ⁺ → K ⁺ π ⁺ π ⁻	
965 ± 10		12	ABLIKIM	05	BES2	J/ψ → φπ ⁺ π ⁻ , φK ⁺ K ⁻	
1031 ± 8		13	ANISOVICH	03	RVUE		
1037 ± 31			TIKHOMIROV	03	SPEC	40.0 π ⁻ C → K _S ⁰ K _S ⁰ K _L ⁰ X	
973 ± 1	2438	14	ALOISIO	02D	KLOE	e ⁺ e ⁻ → π ⁰ π ⁰ γ	
977 ± 3 ± 2	848	15	AITALA	01A	E791	D _s ⁺ → π ⁻ π ⁺ π ⁺	
969.8 ± 4.5	419	16	ACHASOV	00H	SND	e ⁺ e ⁻ → π ⁰ π ⁰ γ	
985 ⁺¹⁶ ₋₁₂	419	17,18	ACHASOV	00H	SND	e ⁺ e ⁻ → π ⁰ π ⁰ γ	OCCUR=2
976 ± 5 ± 6		19	AKHMETSHIN	99B	CMD2	e ⁺ e ⁻ → π ⁺ π ⁻ γ	
977 ± 3 ± 6	268	19	AKHMETSHIN	99C	CMD2	e ⁺ e ⁻ → π ⁰ π ⁰ γ	
975 ± 4 ± 6		20	AKHMETSHIN	99C	CMD2	e ⁺ e ⁻ → π ⁰ π ⁰ γ	OCCUR=2
975 ± 4 ± 6		21	AKHMETSHIN	99C	CMD2	e ⁺ e ⁻ → π ⁺ π ⁻ γ, π ⁰ π ⁰ γ	OCCUR=3
985 ± 10			BARBERIS	99	OMEG	450 pp → p _S p _f K ⁺ K ⁻	
982 ± 3			BARBERIS	99B	OMEG	450 pp → p _S p _f π ⁺ π ⁻	
982 ± 3			BARBERIS	99C	OMEG	450 pp → p _S p _f π ⁰ π ⁰	
987 ± 6 ± 6		22	BARBERIS	99D	OMEG	450 pp → K ⁺ K ⁻ , π ⁺ π ⁻	
989 ± 15			BELLAZZINI	99	GAM4	450 pp → ppπ ⁰ π ⁰	
991 ± 3		23	KAMINSKI	99	RVUE	ππ → ππ, K ⁺ K ⁻ , σσ	
~ 980		23	OLLER	99	RVUE	ππ → ππ, K ⁺ K ⁻	
~ 993.5			OLLER	99B	RVUE	ππ → ππ, K ⁺ K ⁻	
~ 987		23	OLLER	99C	RVUE	ππ → ππ, K ⁺ K ⁻ , ηη	
957 ± 6		24	ACKERSTAFF	98Q	OPAL	Z → f ₀ X	
960 ± 10			ALDE	98	GAM4		
1015 ± 15		23	ANISOVICH	98B	RVUE	Compilation	
1008		25	LOCHER	98	RVUE	ππ → ππ, K ⁺ K ⁻	
955 ± 10		24	ALDE	97	GAM2	450 pp → ppπ ⁰ π ⁰	
994 ± 9		26	BERTIN	97C	OBLX	0.0 p̄p → π ⁺ π ⁻ π ⁰	
993.2 ± 6.5 ± 6.9		27	ISHIDA	96	RVUE	ππ → ππ, K ⁺ K ⁻	
1006			TORNQVIST	96	RVUE	ππ → ππ, K ⁺ K ⁻ , Kπ, ηπ	
997 ± 5	3k	28	ALDE	95B	GAM2	38 π ⁻ p → π ⁰ π ⁰ n	
960 ± 10	10k	29	ALDE	95B	GAM2	38 π ⁻ p → π ⁰ π ⁰ n	OCCUR=2
994 ± 5			AMSLER	95B	CBAR	0.0 p̄p → 3π ⁰	
~ 996		30	AMSLER	95D	CBAR	0.0 p̄p → π ⁰ π ⁰ π ⁰ , π ⁰ ηη, π ⁰ π ⁰ η	
987 ± 6		31	ANISOVICH	95	RVUE		
1015			JANSSEN	95	RVUE	ππ → ππ, K ⁺ K ⁻	
983		32	BUGG	94	RVUE	p̄p → η2π ⁰	
973 ± 2		33	KAMINSKI	94	RVUE	ππ → ππ, K ⁺ K ⁻	
988		34	ZOU	94B	RVUE		
988 ± 10		35	MORGAN	93	RVUE	ππ(K ⁺ K ⁻) → ππ(K ⁺ K ⁻), J/ψ → φππ(K ⁺ K ⁻), D _s → π(ππ)	
971.1 ± 4.0		24	AGUILAR-...	91	EHS	400 pp	
979 ± 4		36	ARMSTRONG	91	OMEG	300 pp → ppππ, ppK ⁺ K ⁻	
956 ± 12			BREAKSTONE	90	SFM	pp → ppπ ⁺ π ⁻	
959.4 ± 6.5		24	AUGUSTIN	89	DM2	J/ψ → ωπ ⁺ π ⁻	
978 ± 9		24	ABACHI	86B	HRS	e ⁺ e ⁻ → π ⁺ π ⁻ X	
985.0 ^{+9.0} _{-39.0}			ETKIN	82B	MPS	23 π ⁻ p → n2K _S ⁰	
974 ± 4		36	GIDAL	81	MRK2	J/ψ → π ⁺ π ⁻ X	
975		37	ACHASOV	80	RVUE		
986 ± 10		36	AGUILAR-...	78	HBC	0.7 p̄p → K _S ⁰ K _S ⁰	
969 ± 5		36	LEEPER	77	ASPK	2-2.4 π ⁻ p → π ⁺ π ⁻ n, K ⁺ K ⁻ n	
987 ± 7		36	BINNIE	73	CNTR	π ⁻ p → nMM	
1012 ± 6		38	GRAYER	73	ASPK	17 π ⁻ p → π ⁺ π ⁻ n	
1007 ± 20		38	HYAMS	73	ASPK	17 π ⁻ p → π ⁺ π ⁻ n	
997 ± 6		38	PROTOPOP...	73	HBC	7 π ⁺ p → π ⁺ pπ ⁺ π ⁻	

- 1 From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.
- 2 Using a relativistic Breit-Wigner function and taking into account the finite D_s mass.
- 3 Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 0$.
- 4 In the kaon-loop fit.
- 5 In the no-structure fit.
- 6 Systematic errors not estimated.
- 7 FLATTE 76 parameterization. $g_{f_0} \pi \pi = 329 \pm 96$ MeV/ c^2 assuming $g_{f_0} K \bar{K} / g_{f_0} \pi \pi = 2$.
- 8 Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- 9 In the kaon-loop fit following formalism of ACHASOV 89.
- 10 In the no-structure fit assuming a direct coupling of ϕ to $f_0 \gamma$.
- 11 FLATTE 76 parameterization. Supersedes GARMASH 05.
- 12 FLATTE 76 parameterization, $g_{f_0} K \bar{K} / g_{f_0} \pi \pi = 4.21 \pm 0.25 \pm 0.21$.
- 13 K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- 14 From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution.
- 15 Coupled-channel Breit-Wigner, couplings $g_\pi = 0.09 \pm 0.01 \pm 0.01$, $g_K = 0.02 \pm 0.04 \pm 0.03$.
- 16 Supersedes ACHASOV 98I. Using the model of ACHASOV 89.
- 17 Supersedes ACHASOV 98I.
- 18 In the "narrow resonance" approximation.
- 19 Assuming $\Gamma(f_0) = 40$ MeV.
- 20 From a narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- 21 From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- 22 Supersedes BARBERIS 99 and BARBERIS 99B
- 23 T-matrix pole.
- 24 From invariant mass fit.
- 25 On sheet II in a 2 pole solution. The other pole is found on sheet III at (1039–93i) MeV.
- 26 On sheet II in a 2 pole solution. The other pole is found on sheet III at (963–29i) MeV.
- 27 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 28 At high $|t|$.
- 29 At low $|t|$.
- 30 On sheet II in a 4-pole solution, the other poles are found on sheet III at (953–55i) MeV and on sheet IV at (938–35i) MeV.
- 31 Combined fit of ALDE 95B, ANISOVICH 94, AMSLER 94D.
- 32 On sheet II in a 2 pole solution. The other pole is found on sheet III at (996–103i) MeV.
- 33 From sheet II pole position.
- 34 On sheet II in a 2 pole solution. The other pole is found on sheet III at (797–185i) MeV and can be interpreted as a shadow pole.
- 35 On sheet II in a 2 pole solution. The other pole is found on sheet III at (978–28i) MeV.
- 36 From coupled channel analysis.
- 37 Coupled channel analysis with finite width corrections.
- 38 Included in AGUILAR-BENITEZ 78 fit.

NODE=M003M1;LINKAGE=F

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NODE=M003M1;LINKAGE=MO

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NODE=M003M1;LINKAGE=V8
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NODE=M003M1;LINKAGE=ST

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NODE=M003M1;LINKAGE=A
NODE=M003M1;LINKAGE=LC
NODE=M003M1;LINKAGE=X
NODE=M003M1;LINKAGE=AA

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NODE=M003M1;LINKAGE=LB
NODE=M003M1;LINKAGE=KL

NODE=M003M1;LINKAGE=CF
NODE=M003M1;LINKAGE=C2
NODE=M003M1;LINKAGE=KM
NODE=M003M1;LINKAGE=L

NODE=M003M1;LINKAGE=K
NODE=M003M1;LINKAGE=B
NODE=M003M1;LINKAGE=B
NODE=M003M1;LINKAGE=R

$f_0(980)$ WIDTH

Width determination very model dependent. Peak width in $\pi\pi$ is about 50 MeV, but decay width can be much larger.

NODE=M003W1

NODE=M003W1

NODE=M003W1

→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 to 100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
15.3 ± 4.7	424	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
9.5 ± 1.1	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
91 $^{+30}_{-22}$ ± 3	44	1 ECKLUND	09 CLEO	4.17 $e^+ e^- \rightarrow D_s^- D_s^{*+} + c.c.$
66.9 ± 2.2 $^{+17.6}_{-12.5}$		2 UEHARA	08A BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
65 ± 13	262 ± 30	3 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$

81 ± 21	54 ± 9	3	AUBERT	07AK	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\pi^0\gamma$	OCCUR=2
51.3 ⁺ ₋ 20.8 ⁺ ₋ 17.7 ⁺ ₋ 13.2 ⁺ ₋ 3.8		4	MORI	07	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$	
61 ± 9 ⁺¹⁴ ₋₈	2584	5	GARMASH	05	BELL	$B^+ \rightarrow K^+\pi^+\pi^-$	
64 ± 16		6	ANISOVICH	03	RVUE		
121 ± 23			TIKHOMIROV	03	SPEC	40.0 $\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 70		7	BRAMON	02	RVUE	1.02 $e^+e^- \rightarrow \pi^0\pi^0\gamma$	
44 ± 2 ± 2	848	8	AITALA	01A	E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$	
201 ± 28	419	9	ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	OCCUR=2
122 ± 13	419	10,11	ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
56 ± 20		12	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
65 ± 20			BARBERIS	99	OMEG	450 $pp \rightarrow p_s p_f K^+ K^-$	
80 ± 10			BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$	
80 ± 10			BARBERIS	99C	OMEG	450 $pp \rightarrow p_s p_f \pi^0 \pi^0$	
48 ± 12 ± 8		13	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
65 ± 25			BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$	
71 ± 14		14	KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
~ 28		14	OLLER	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 25			OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 14		14	OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
70 ± 20			ALDE	98	GAM4		
86 ± 16		14	ANISOVICH	98B	RVUE	Compilation	
54		15	LOCHER	98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
69 ± 15		16	ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$	
38 ± 20		17	BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
~ 100		18	ISHIDA	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
34			TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$	
48 ± 10	3k	19	ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	OCCUR=2
95 ± 20	10k	20	ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	
26 ± 10			AMSLER	95B	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$	
~ 112		21	AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$	
80 ± 12		22	ANISOVICH	95	RVUE		
30			JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
74		23	BUGG	94	RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
29 ± 2		24	KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
46		25	ZOU	94B	RVUE		
48 ± 12		26	MORGAN	93	RVUE	$\pi\pi(K\bar{K}) \rightarrow \pi\pi(K\bar{K}), J/\psi \rightarrow \phi\pi\pi(K\bar{K}), D_s \rightarrow \pi(\pi\pi)$	
37.4 ± 10.6		16	AGUILAR...	91	EHS	400 pp	
72 ± 8		27	ARMSTRONG	91	OMEG	300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$	
110 ± 30			BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+\pi^-$	
29 ± 13		16	ABACHI	86B	HRS	$e^+e^- \rightarrow \pi^+\pi^-X$	
120 ± 281 ± 20			ETKIN	82B	MPS	23 $\pi^-p \rightarrow n 2K_S^0$	
28 ± 10		27	GIDAL	81	MRK2	$J/\psi \rightarrow \pi^+\pi^-X$	
70 to 300		28	ACHASOV	80	RVUE		
100 ± 80		29	AGUILAR...	78	HBC	0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
30 ± 8		27	LEEPER	77	ASPK	2-2.4 $\pi^-p \rightarrow \pi^+\pi^-n, K^+K^-n$	
48 ± 14		27	BINNIE	73	CNTR	$\pi^-p \rightarrow nMM$	
32 ± 10		30	GRAYER	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
30 ± 10		30	HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
54 ± 16		30	PROTOPOP...	73	HBC	7 $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$	

- 1 Using a relativistic Breit-Wigner function and taking into account the finite D_S mass.
- 2 Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 0$.
- 3 Systematic errors not estimated.
- 4 Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- 5 Breit-Wigner, solution 1, PWA ambiguous.
- 6 K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- 7 Using the data of AKHMETSHIN 99C, ACHASOV 00H, and ALOISIO 02D.
- 8 Breit-Wigner width.
- 9 Supersedes ACHASOV 98I. Using the model of ACHASOV 89.
- 10 Supersedes ACHASOV 98I.
- 11 In the "narrow resonance" approximation.
- 12 From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- 13 Supersedes BARBERIS 99 and BARBERIS 99B.
- 14 T-matrix pole.
- 15 On sheet II in a 2 pole solution. The other pole is found on sheet III at (1039–93*i*) MeV.
- 16 From invariant mass fit.
- 17 On sheet II in a 2 pole solution. The other pole is found on sheet III at (963–29*i*) MeV.
- 18 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 19 At high $|t|$.
- 20 At low $|t|$.
- 21 On sheet II in a 4-pole solution, the other poles are found on sheet III at (953–55*i*) MeV and on sheet IV at (938–35*i*) MeV.
- 22 Combined fit of ALDE 95B, ANISOVICH 94.
- 23 On sheet II in a 2 pole solution. The other pole is found on sheet III at (996–103*i*) MeV.
- 24 From sheet II pole position.
- 25 On sheet II in a 2 pole solution. The other pole is found on sheet III at (797–185*i*) MeV and can be interpreted as a shadow pole.
- 26 On sheet II in a 2 pole solution. The other pole is found on sheet III at (978–28*i*) MeV.
- 27 From coupled channel analysis.
- 28 Coupled channel analysis with finite width corrections.
- 29 From coupled channel fit to the HYAMS 73 and PROTOPODESCU 73 data. With a simultaneous fit to the $\pi\pi$ phase-shifts, inelasticity and to the $K_S^0 K_S^0$ invariant mass.
- 30 Included in AGUILAR-BENITEZ 78 fit.

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 NODE=M003W;LINKAGE=C
 NODE=M003W;LINKAGE=R

$f_0(980)$ DECAY MODES

NODE=M003215;NODE=M003

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\gamma\gamma$	seen
Γ_4 $e^+ e^-$	

DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=4

$f_0(980)$ PARTIAL WIDTHS

NODE=M003220

$\Gamma(\gamma\gamma)$	VALUE (keV)	DOCUMENT ID	TECN	COMMENT	Γ_3
------------------------	-------------	-------------	------	---------	------------

NODE=M003W4
 NODE=M003W4

0.29 $^{+0.11}_{-0.06}$ OUR AVERAGE

0.286 ± 0.017 $^{+0.211}_{-0.070}$	1	UEHARA	08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
0.205 $^{+0.095+0.147}_{-0.083-0.117}$	2	MORI	07	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
0.42 $\pm 0.06 \pm 0.18$	3	OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.32 ±0.05	4 DAI	14A	RVUE	Compilation
0.16 ±0.01	5 MENNESSIER	11	RVUE	
0.29 ±0.21 $\begin{smallmatrix} +0.02 \\ -0.07 \end{smallmatrix}$	6 MOUSSALLAM	11	RVUE	Compilation
0.42	7,8 PENNINGTON	08	RVUE	Compilation
0.10	8,9 PENNINGTON	08	RVUE	Compilation
0.28 $\begin{smallmatrix} +0.09 \\ -0.13 \end{smallmatrix}$	10 BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
0.29 ±0.07 ±0.12	11,12 BOYER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
0.31 ±0.14 ±0.09	11,12 MARSISKE	90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
0.63 ±0.14	13 MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$

OCCUR=2

¹ Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 KK}/g_{f_0 \pi\pi} = 0$.

NODE=M003W4;LINKAGE=UE

² Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 KK}/g_{f_0 \pi\pi} = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.

NODE=M003W4;LINKAGE=MO

³ OEST 90 quote systematic errors $\begin{smallmatrix} +0.08 \\ -0.18 \end{smallmatrix}$. We use ± 0.18 . Observed 60 events.

NODE=M003W4;LINKAGE=H

⁴ Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

NODE=M003W4;LINKAGE=D

⁵ Uses an analytic K-matrix model. Compilation.

NODE=M003W4;LINKAGE=ME

⁶ Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

NODE=M003W4;LINKAGE=MU

⁷ Solution A (preferred solution based on χ^2 -analysis).

NODE=M003W4;LINKAGE=P1

⁸ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

NODE=M003W4;LINKAGE=P3

⁹ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

NODE=M003W4;LINKAGE=P2

¹⁰ Supersedes MORGAN 90.

NODE=M003W4;LINKAGE=BL

¹¹ From analysis allowing arbitrary background unconstrained by unitarity.

NODE=M003W4;LINKAGE=B

¹² Data included in MORGAN 90, BOGLIONE 99 analyses.

NODE=M003W4;LINKAGE=C

¹³ From amplitude analysis of BOYER 90 and MARSISKE 90, data corresponds to resonance parameters $m = 989$ MeV, $\Gamma = 61$ MeV.

NODE=M003W4;LINKAGE=A

$\Gamma(e^+e^-)$

Γ_4

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<8.4	90	VOROBYEV	88	ND $e^+e^- \rightarrow \pi^0\pi^0$

NODE=M003W3
NODE=M003W3

$f_0(980)$ BRANCHING RATIOS

NODE=M003225

$\Gamma(\pi\pi)/[\Gamma(\pi\pi) + \Gamma(K\bar{K})]$

$\Gamma_1/(\Gamma_1+\Gamma_2)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M003R1
NODE=M003R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.52 ±0.12	9.9k	1 AUBERT	060	BABR	$B^\pm \rightarrow K^\pm \pi^\pm \pi^\mp$
0.75 $\begin{smallmatrix} +0.11 \\ -0.13 \end{smallmatrix}$		2 ABLIKIM	05Q	BES2	$\chi_{c0} \rightarrow 2\pi^+ 2\pi^-,$ $\pi^+\pi^- K^+ K^-$
0.84 ±0.02		3 ANISOVICH	02D	SPEC	Combined fit
~ 0.68		OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
0.67 ±0.09		4 LOVERRE	80	HBC	$4 \pi^- p \rightarrow n 2K_S^0$
0.81 $\begin{smallmatrix} +0.09 \\ -0.04 \end{smallmatrix}$		4 CASON	78	STRC	$7 \pi^- p \rightarrow n 2K_S^0$
0.78 ±0.03		4 WETZEL	76	OSPK	$8.9 \pi^- p \rightarrow n 2K_S^0$

¹ Recalculated by us using $\Gamma(K^+ K^-) / \Gamma(\pi^+ \pi^-) = 0.69 \pm 0.32$ from AUBERT 060 and isospin relations.

NODE=M003R1;LINKAGE=AU

² Using data from ABLIKIM 04G.

NODE=M003R1;LINKAGE=AB

³ From a combined K-matrix analysis of Crystal Barrel ($p\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M003R;LINKAGE=CH

⁴ Measure $\pi\pi$ elasticity assuming two resonances coupled to the $\pi\pi$ and $K\bar{K}$ channels only.

NODE=M003R1;LINKAGE=B

f₀(980) REFERENCES

NODE=M003

HOFRICHT...	24	PL B853 138698	M. Hoferichter <i>et al.</i>	(BERN, MADU, BONN+)	REFID=63010
DANILKIN	21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen	(MAINZ)	REFID=62088
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59670
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>		REFID=59987
HOFRICHT...	16	PRPL 625 1	M. Hoferichter <i>et al.</i>	(WASH, BONN)	REFID=63224
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)	REFID=55923
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=16761
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=54121
MENNESSIER	11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang		REFID=53637
MOUSSALLAM	11	EPJ C71 1814	B. Moussallam		REFID=53975
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53567
MENNESSIER	10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang		REFID=53657
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
ECKLUND	09	PR D80 052009	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=53041
BATLEY	08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=52487
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>		REFID=52303
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
AMBROSINO	06B	PL B634 148	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51043
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51141
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=51162
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
ACHASOV	05	PR D72 013006	N.N. Achasov, G.N. Shestakov		REFID=50762
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=50641
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
BUETTIKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam		REFID=56428;ERROR=6
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			
BRAMON	02	EPJ C26 253	A. Bramon <i>et al.</i>		REFID=49178
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	99C	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99B	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99C	PL B453 325	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46923
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>		REFID=47400
BOGLIONE	99	EPJ C9 11	M. Boggione, M.R. Pennington		REFID=46931
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (err.)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (err.)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
ACKERSTAFF	98Q	EPJ C4 19	K. Akerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46145
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
ISHIDA	96	PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HEL5)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
MORGAN	93	PR D48 1185	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=43614
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			

ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)
ACHASOV	80	SJNP 32 566	N.N. Achasov, S.A. Devyanin, G.N. Shestakov	(NOVM)
		Translated from YAF 32 1098.		
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+) IJP
AGUILAR-...	78	NP B140 73	M. Aguilar-Benitez <i>et al.</i>	(MADR, BOMB+)
CASON	78	PRL 41 271	N.M. Cason <i>et al.</i>	(NDAM, ANL)
LEEPER	77	PR D16 2054	R.J. Leeper <i>et al.</i>	(ISU)
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)
BINNIE	73	PRL 31 1534	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)
GRAYER	73	Tallahassee	G. Grayer <i>et al.</i>	(CERN, MPIM)
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)

REFID=20394
REFID=20768
REFID=21418
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REFID=21062
REFID=20111
REFID=20113
REFID=20343
REFID=20347
REFID=20107
REFID=20108

NODE=M036

$a_0(980)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the related review(s):
Scalar Mesons below 1 GeV

$a_0(980)$ T-MATRIX POLE \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(970-1020) - i (30-70) OUR ESTIMATE (see Fig. 64.2 in the review)			
$(1002.4 \pm 1.4 \pm 6.6)$ $-i(63.5 \pm 2.9)$	¹ ALBRECHT	20 CBAR	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1000.7^{+12.9}_{-0.7})$ $-i(36.6^{+12.7}_{-2.6})$	² LU	20 RVUE	$\gamma\gamma \rightarrow \pi^0 \eta, K_S^0 K_S^0$
$(989 \pm 5) - i(40 \pm 5)$	³ BUGG	08A RVUE	$\bar{p}p$ annihilation data
$(1117^{+24}_{-320}) - i(12^{+43}_{-12})$	⁴ PELAEZ	04A RVUE	$\pi\pi \rightarrow \pi\pi, \pi K \rightarrow \pi K$
$(982 \pm 3) - i(46 \pm 4)$	⁵ ABELE	98 CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

¹ Pole mass on sheet closest to the physical axis - the more remote pole is extracted at $(1004.1 \pm 1.5 \pm 6.5) - i(48.6 \pm 1.2 \pm 3.4)$ MeV.

² T-matrix pole on sheet II.

³ T-matrix pole on sheet II. Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$. Uses AM-SLER 94D and ABELE 98.

⁴ Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.

⁵ T-matrix pole on sheet II; the pole on sheet III is at $(1006 - i 49)$ MeV.

NODE=M036PP

NODE=M036PP

NODE=M036PP

→ UNCHECKED ←

NODE=M036PP;LINKAGE=E

NODE=M036PP;LINKAGE=LU

NODE=M036PP;LINKAGE=C

NODE=M036PP;LINKAGE=A

NODE=M036PP;LINKAGE=D

$a_0(980)$ MASS

VALUE (MeV)	DOCUMENT ID
980 ± 20 OUR ESTIMATE	Mass determination very model dependent

NODE=M036205

NODE=M036MX

→ UNCHECKED ←

$\eta\pi$ FINAL STATE ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$982.5 \pm 1.6 \pm 1.1$	16.9k	¹ AMBROSINO	09F KLOE		$1.02 e^+ e^- \rightarrow \eta\pi^0 \gamma$
986 ± 4		ANISOVICH	09 RVUE		$0.0 \bar{p}p, \pi N$
$982.3^{+0.6}_{-0.7} \pm 3.1_{-4.7}$		² UEHARA	09A BELL		$\gamma\gamma \rightarrow \pi^0 \eta$
$985 \pm 4 \pm 6$	318	ACHARD	02B L3		$183-209 e^+ e^- \rightarrow$ $e^+ e^- \eta\pi^+ \pi^-$
995^{+52}_{-10}	36	³ ACHASOV	00F SND		$e^+ e^- \rightarrow \eta\pi^0 \gamma$
994^{+33}_{-8}	36	⁴ ACHASOV	00F SND		$e^+ e^- \rightarrow \eta\pi^0 \gamma$
975 ± 7		BARBERIS	00H		$450 pp \rightarrow p_f \eta\pi^0 p_s$

NODE=M036M1

NODE=M036M1

OCCUR=2

988 ± 8		BARBERIS	00H	450 $p\bar{p} \rightarrow \Delta_f^{++} \eta \pi^- p_S$	OCCUR=2
~ 1055		⁵ OLLER	99 RVUE	$\eta \pi, K\bar{K}$	
~ 1009.2		⁵ OLLER	99B RVUE	$\pi \pi \rightarrow \pi \pi, K\bar{K}$	
993.1 ± 2.1		⁶ TEIGE	99 B852	18.3 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$	
988 ± 6		⁵ ANISOVICH	98B RVUE	Compilation	
987		TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K\bar{K}, K\pi, \eta \pi$	
991		JANSSEN	95 RVUE	$\eta \pi \rightarrow \eta \pi, K\bar{K}, K\pi, \eta \pi$	
984.45 ± 1.23 ± 0.34		AMSLER	94C CBAR	0.0 $\bar{p}p \rightarrow \omega \eta \pi^0$	
982 ± 2		⁷ AMSLER	92 CBAR	0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$	
984 ± 4	1040	⁷ ARMSTRONG	91B OMEG ±	300 $p\bar{p} \rightarrow p\bar{p} \eta \pi^+ \pi^-$	
976 ± 6		ATKINSON	84E OMEG ±	25-55 $\gamma p \rightarrow \eta \pi n$	
986 ± 3	500	⁸ EVANGELIS...	81 OMEG ±	12 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$	
990 ± 7	145	⁸ GURTU	79 HBC ±	4.2 $K^- p \rightarrow \Lambda \eta 2\pi$	
980 ± 11	47	CONFORTO	78 OSPK -	4.5 $\pi^- p \rightarrow \rho X^-$	
978 ± 16	50	CORDEN	78 OMEG ±	12-15 $\pi^- p \rightarrow n \eta 2\pi$	
977 ± 7		GRASSLER	77 HBC -	16 $\pi^+ p \rightarrow \rho \eta 3\pi$	
989 ± 4	70	WELLS	75 HBC -	3.1-6 $K^- p \rightarrow \Lambda \eta 2\pi$	OCCUR=2
972 ± 10	150	DEFOIX	72 HBC ±	0.7 $\bar{p}p \rightarrow 7\pi$	
970 ± 15	20	BARNES	69C HBC -	4-5 $K^- p \rightarrow \Lambda \eta 2\pi$	
980 ± 10		CAMPBELL	69 DBC ±	2.7 $\pi^+ d$	
980 ± 10	15	MILLER	69B HBC -	4.5 $K^- N \rightarrow \eta \pi \Lambda$	
980 ± 10	30	AMMAR	68 HBC ±	5.5 $K^- p \rightarrow \Lambda \eta 2\pi$	

- ¹ Using the model of ACHASOV 89 and ACHASOV 03B.
- ² From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.
- ³ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.
- ⁴ Using the model of JAFFE 77. Supersedes ACHASOV 98B.
- ⁵ T-matrix pole.
- ⁶ Breit-Wigner fit, average between a_0^\pm and a_0^0 . The fit favors a slightly heavier a_0^\pm .
- ⁷ From a single Breit-Wigner fit.
- ⁸ From $f_1(1285)$ decay.

NODE=M036M1;LINKAGE=AM
 NODE=M036M1;LINKAGE=UE
 NODE=M036M1;LINKAGE=V1
 NODE=M036M1;LINKAGE=M2
 NODE=M036M1;LINKAGE=AN
 NODE=M036M1;LINKAGE=BF
 NODE=M036M1;LINKAGE=A
 NODE=M036M1;LINKAGE=R

K \bar{K} ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
947.7 ⁺ _{-5.0} ± 6.6		¹ AAIJ	19H LHCb	$p\bar{p} \rightarrow D^\pm X$
925 ± 5 ± 8	190k	² AAIJ	16N LHCb	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
~ 1053		³ OLLER	99C RVUE	$\pi \pi \rightarrow \pi \pi, K\bar{K}$
975 ± 15		BERTIN	98B OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
970 ± 10	316	DEBILLY	80 HBC	1.2-2 $\bar{p}p \rightarrow f_1(1285)\omega$
1016 ± 10	100	⁴ ASTIER	67 HBC	0.0 $\bar{p}p$
1003.3 ± 7.0	143	^{5,6} ROSENFELD	65 RVUE	

- ¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.
- ² Using a two-channel resonance parametrization with couplings fixed to ABELE 98.
- ³ T-matrix pole.
- ⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
- ⁵ Note on J^P . Main argument for 0^+ is small Q value. Isotropy of decay distribution in $\bar{p}p$ at rest proves nothing. See discussion by Rosenfeld (Oxford) and Butterworth (Heidelberg).
- ⁶ Plus systematic errors.

NODE=M036M2;LINKAGE=C
 NODE=M036M2;LINKAGE=B
 NODE=M036M2;LINKAGE=AN
 NODE=M036M2;LINKAGE=A
 NODE=M036M2;LINKAGE=01
 NODE=M036M2;LINKAGE=S

$a_0(980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
50 to 100 OUR ESTIMATE					Width determination very model dependent. Peak width in $\eta \pi$ is about 60 MeV, but decay width can be much larger.

- • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M036210
 NODE=M036W1
 → UNCHECKED ←

75.6 ± 1.6	$\frac{+17.4}{-10.0}$		¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$	
50 ± 13	± 4	318	ACHARD	02B	L3	$183-209 e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$	
72 ± 16			BARBERIS	00H		450 $pp \rightarrow p_f\eta\pi^0 p_s$	
61 ± 19			BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++}\eta\pi^- p_s$	OCCUR=2
~ 42			² OLLER	99	RVUE	$\eta\pi, K\bar{K}$	
~ 112			² OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$	
71 ± 7			TEIGE	99	B852	18.3 $\pi^- p \rightarrow \eta\pi^+\pi^- n$	
92 ± 20			² ANISOVICH	98B	RVUE	Compilation	
65 ± 10			³ BERTIN	98B	OBLX ±	0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$	
~ 100			TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$	
202			JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$	
54.12 ± 0.34 ± 0.12			AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$	
54 ± 10			⁴ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$	
95 ± 14		1040	⁴ ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow \rho\rho\eta\pi^+\pi^-$	
62 ± 15		500	⁵ EVANGELIS...	81	OMEG ±	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$	
60 ± 20		145	⁵ GURTU	79	HBC ±	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$	
60 $\frac{+50}{-30}$		47	CONFORTO	78	OSPK -	4.5 $\pi^- p \rightarrow pX^-$	
86.0 $\frac{+60.0}{-50.0}$		50	CORDEN	78	OMEG ±	12-15 $\pi^- p \rightarrow n\eta 2\pi$	
44 ± 22			GRASSLER	77	HBC -	16 $\pi^\mp p \rightarrow p\eta 3\pi$	
80 to 300			⁶ FLATTE	76	RVUE -	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$	
16.0 $\frac{+25.0}{-16.0}$		70	⁷ WELLS	75	HBC -	3.1-6 $K^- p \rightarrow \Lambda\eta 2\pi$	
30 ± 5		150	⁸ DEFOIX	72	HBC ±	0.7 $\bar{p}p \rightarrow 7\pi$	
40 ± 15			CAMPBELL	69	DBC ±	2.7 $\pi^+ d$	
60 ± 30		15	MILLER	69B	HBC -	4.5 $K^- N \rightarrow \eta\pi\Lambda$	
80 ± 30		30	AMMAR	68	HBC ±	5.5 $K^- p \rightarrow \Lambda\eta 2\pi$	

¹From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

²T-matrix pole.

³The $\eta\pi$ width.

⁴From a single Breit-Wigner fit.

⁵From $f_1(1285)$ decay.

⁶Using a two-channel resonance parametrization of GAY 76B data.

⁷Weak evidence only for $a_0(980)^+$ production.

⁸This number has very little meaning. Error is much too small. Vlada

NODE=M036W1;LINKAGE=UE

NODE=M036W1;LINKAGE=AN
 NODE=M036W1;LINKAGE=BE
 NODE=M036W1;LINKAGE=A
 NODE=M036W1;LINKAGE=R
 NODE=M036W1;LINKAGE=F
 NODE=M036W1;LINKAGE=W
 NODE=M036W1;LINKAGE=01

K \bar{K} ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 48		¹ OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	² ASTIER	67	HBC ±	
57 ± 13	143	³ ROSENFELD	65	RVUE ±	

¹T-matrix pole.

²ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

³Plus systematic errors.

NODE=M036W2
 NODE=M036W2

NODE=M036W2;LINKAGE=AN
 NODE=M036W2;LINKAGE=A
 NODE=M036W2;LINKAGE=S

$a_0(980)$ DECAY MODES

NODE=M036215;NODE=M036

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \eta\pi$	seen
$\Gamma_2 K\bar{K}$	seen
$\Gamma_3 \eta'\pi$	seen
$\Gamma_4 \rho\pi$	not seen
$\Gamma_5 \gamma\gamma$	seen
$\Gamma_6 e^+e^-$	

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=8
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6

$a_0(980)$ PARTIAL WIDTHS

NODE=M036217

 $\Gamma(\gamma\gamma)$ **Γ_5**

VALUE (keV)	DOCUMENT ID	TECN
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NODE=M036W4
NODE=M036W4

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.30 ± 0.10 ¹ AMSLER 98 RVUE¹ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.

NODE=M036W4;LINKAGE=A

 $a_0(980) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M036220

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_5/\Gamma$**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M036G1
NODE=M036G1**0.21 ^{+0.08}_{-0.04} OUR AVERAGE**0.128 ^{+0.003+0.502}_{-0.002-0.043} ¹ UEHARA 09A BELL $\gamma\gamma \rightarrow \pi^0\eta$ 0.28 ± 0.04 ± 0.10 44 OEST 90 JADE $e^+e^- \rightarrow e^+e^-\pi^0\eta$ 0.19 ± 0.07 ^{+0.10}_{-0.07} ANTREASYAN 86 CBAL $e^+e^- \rightarrow e^+e^-\pi^0\eta$ ¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

NODE=M036G1;LINKAGE=UE

 $\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_6/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M036G2
NODE=M036G2<1.5 90 VOROBYEV 88 ND $e^+e^- \rightarrow \pi^0\eta$ **$a_0(980)$ BRANCHING RATIOS**

NODE=M036225

 $\Gamma(K\bar{K})/\Gamma(\eta\pi)$ **Γ_2/Γ_1**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M036R2
NODE=M036R2**0.172 ± 0.019 OUR AVERAGE**0.137 ± 0.036 ± 0.042 ¹ ABLIKIM 22AH BES3 $D_s^+ \rightarrow K_S^0 K^+ \pi^0$ 0.23 ± 0.05 ² ABELE 98 CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$ 0.166 ± 0.01 ± 0.02 ³ BARBERIS 98C OMEG $450 pp \rightarrow p_f f_1(1285) p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.138 ± 0.001 ± 0.035 ⁴ ALBRECHT 20 CBAR $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta,$
 $\pi^0\eta\eta, \pi^0 K^+ K^-$ 1.20 ± 0.15 ⁵ ANISOVICH 09 RVUE $0.0 \bar{p}p, \pi N$ 1.05 ± 0.07 ± 0.05 ⁶ BUGG 08A RVUE 0 $\bar{p}p \rightarrow \pi^0\pi^0\eta$ 0.57 ± 0.16 ⁷ BARGIOTTI 03 OBLX $\bar{p}p$ ~ 0.60 OLLER 99B RVUE $\pi\pi \rightarrow \eta\pi, K\bar{K}$ 0.7 ± 0.3 ³ CORDEN 78 OMEG $12-15 \pi^- p \rightarrow n\eta 2\pi$ 0.25 ± 0.08 ³ DEFOIX 72 HBC ± $0.7 \bar{p} \rightarrow 7\pi$ ¹ Using $D_s^+ \rightarrow a_0(980)^+ \pi^0$ from ABLIKIM 19BE.² Using $\pi^0\pi^0\eta$ from AMSLER 94D.³ From the decay of $f_1(1285)$.⁴ Residues from T-matrix pole with 2 poles, 2 channels. Solution on adjacent sheet $0.149 \pm 0.001 \pm 0.039$.⁵ This is a ratio of couplings.⁶ A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94.⁷ Coupled channel analysis of $\pi^+\pi^-\pi^0, K^+K^-\pi^0,$ and $K^\pm K_S^0 \pi^\mp$.

NODE=M036R2;LINKAGE=B

NODE=M036R2;LINKAGE=Q

NODE=M036R2;LINKAGE=L

NODE=M036R2;LINKAGE=A

NODE=M036R2;LINKAGE=AN

NODE=M036R2;LINKAGE=BU

NODE=M036R;LINKAGE=BG

 $\Gamma(\eta'\pi)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M036R00
NODE=M036R00seen 116k ¹ CHEN 20A BELL $D^0 \rightarrow K^- \pi^+ \eta$ ¹ From an amplitude analysis of the $D^0 \rightarrow K^- \pi^+ \eta$ decay in a three-channel Flatte model with a 10.1 σ significance. Earlier observed by ABLIKIM 17K in the $\chi_{c1} \rightarrow \eta\pi^+\pi^-$ decay with a 8.9 σ significance.

NODE=M036R00;LINKAGE=A

 $\Gamma(\rho\pi)/\Gamma(\eta\pi)$ **Γ_4/Γ_1** $\rho\pi$ forbidden.

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M036R1
NODE=M036R1
NODE=M036R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.25 70 ¹ AMMAR 70 HBC ± $4.1, 5.5 K^- p \rightarrow \Lambda\eta 2\pi$ ¹ Not clear if they really observed the $a_0(980)$ 3 standard deviations.

NODE=M036R1;LINKAGE=01

a₀(980) REFERENCES

NODE=M036

ABLIKIM	22AH	PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61880
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)	REFID=60333
LU	20	EPJ C80 436	J. Lu, B. Moussallam		REFID=60436
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59670
ABLIKIM	19BE	PRL 123 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60055
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>		REFID=59987
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57953
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=53105
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)	REFID=52578
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
ACHASOV	03B	PR D68 014006	N.N. Achsaov, A.V. Kiselev		REFID=49476
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
OLLER	99	PR D60 099906 (errat.)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (errat.)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)	REFID=46613
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45863
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
AMSLER	98	RMP 70 1293	C. Amsler		REFID=46601
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
JANSSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=20469
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20624
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)	REFID=20461
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)	REFID=20456
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TINTO, CHIC+)	REFID=20451
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20452
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20447
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)	REFID=43673
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)	REFID=20446
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP	REFID=20445
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)	REFID=20444
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)	REFID=20428
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)	REFID=20418
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)	REFID=20419
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)	REFID=20424
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)	REFID=20425
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)	REFID=20412
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)	REFID=20405
Includes data of		BARLOW 67, CONFORTO 67, and ARMENTEROS 65.			
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIPV)	REFID=20041
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)	REFID=20411
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)	REFID=20396
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)	REFID=20399

$\phi(1020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M004

 $\phi(1020)$ MASS

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.460 ±0.016 OUR AVERAGE				
[1019.461 ± 0.016 MeV OUR 2024 AVERAGE]				
1019.443 ±0.010 ±0.060	1.28M	¹ ACHASOV	24 SND	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.463 ±0.061	2.3M	² KOZYREV	18 CMD3	$e^+e^- \rightarrow K^+ K^-$, $K_S^0 K_L^0$
1019.462 ±0.042 ±0.056	28k	³ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
1019.51 ±0.02 ±0.05		⁴ LEES	13Q BABR	$e^+e^- \rightarrow K^+ K^- \gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN	06 CMD2	$0.98-1.06 e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN	05 CMD2	$0.60-1.38 e^+e^- \rightarrow \eta \gamma$
1019.483 ±0.011 ±0.025	272k	⁵ AKHMETSHIN	04 CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	⁶ ACHASOV	01E SND	$e^+e^- \rightarrow K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$
1019.40 ±0.04 ±0.05	23k	AKHMETSHIN	01B CMD2	$e^+e^- \rightarrow \eta \gamma$
1019.36 ±0.12		⁷ ACHASOV	00B SND	$e^+e^- \rightarrow \eta \gamma$
1019.38 ±0.07 ±0.08	2200	⁸ AKHMETSHIN	99F CMD2	$e^+e^- \rightarrow \pi^+ \pi^- \geq 2\gamma$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN	98 CMD2	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.5 ±0.4		BARBERIS	98 OMEG	$450 pp \rightarrow pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN	95 CMD2	$e^+e^- \rightarrow \text{hadrons}$
1019.7 ±0.3	2012	DAVENPORT	86 MPSF	$400 pA \rightarrow 4K X$
1019.7 ±0.1 ±0.1	5079	ALBRECHT	85D ARG	$10 e^+e^- \rightarrow K^+ K^- X$
1019.3 ±0.1	1500	ARENTON	82 AEMS	$11.8 \text{ polar. } pp \rightarrow KK$
1019.67 ±0.17	25080	⁹ PELLINEN	82 RVUE	
1019.52 ±0.13	3681	BUKIN	78C OLYA	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1019.0330 ±0.0084		¹⁰ DUBNICKA	24 RVUE	$e^+e^- \rightarrow K^+ K^-$, $K_S^0 K_L^0$
1019.761 ±0.130	34M	¹¹ IGNATOV	24 CMD3	$e^+e^- \rightarrow \pi^+ \pi^-$
1018.4 ±0.5 ±0.1		¹² ALBRECHT	20 CBAR	$0.9 \bar{p}p \rightarrow K^+ K^- \pi^0$
1019.21 ±0.04 ±0.03		¹³ HOID	20 RVUE	$e^+e^- \rightarrow \pi^0 \gamma$
1019.54 ±0.10 ±0.51		¹⁴ AAIJ	19H LHCB	$pp \rightarrow D^\pm X$
1019.20 ±0.02 ±0.01		¹⁵ HOFERICHT...	19 RVUE	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
1019.469 ±0.061	1.7M	KOZYREV	18 CMD3	$e^+e^- \rightarrow K^+ K^-$
1019.457 ±0.061	610k	KOZYREV	16 CMD3	$e^+e^- \rightarrow K_S^0 K_L^0$
1019.48 ±0.01		LEES	13F BABR	$D^+ \rightarrow K^+ K^- \pi^+$
1019.441 ±0.008 ±0.080	542k	¹⁶ AKHMETSHIN	08 CMD2	$1.02 e^+e^- \rightarrow K^+ K^-$
1019.63 ±0.07	12540	¹⁷ AUBERT,B	05J BABR	$D^0 \rightarrow \bar{K}^0 K^+ K^-$
1019.8 ±0.7		ARMSTRONG	86 OMEG	$85 \pi^+ / pp \rightarrow \pi^+ / p4Kp$
1020.1 ±0.11	5526	¹⁷ ATKINSON	86 OMEG	$20-70 \gamma p$
1019.7 ±1.0		BEBEK	86 CLEO	$e^+e^- \rightarrow T(4S)$
1019.411 ±0.008	642k	¹⁸ DIJKSTRA	86 SPEC	$100-200 \pi^\pm, \bar{p}, p, K^\pm, \text{ on Be}$
1020.9 ±0.2		¹⁷ FRAME	86 OMEG	$13 K^+ p \rightarrow \phi K^+ p$
1021.0 ±0.2		¹⁷ ARMSTRONG	83B OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
1020.0 ±0.5		¹⁷ ARMSTRONG	83B OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
1019.7 ±0.3		¹⁷ BARATE	83 GOLI	$190 \pi^- \text{Be} \rightarrow 2\mu X$
1019.8 ±0.2 ±0.5	766	IVANOV	81 OLYA	$1-1.4 e^+e^- \rightarrow K^+ K^-$
1019.4 ±0.5	337	COOPER	78B HBC	$0.7-0.8 \bar{p}p \rightarrow K_S^0 K_L^0 \pi^+ \pi^-$

NODE=M004M

NEW

OCCUR=2

OCCUR=2

OCCUR=2

1020	±1	383	¹⁷ BALDI	77	CNTR	10 $\pi^- p \rightarrow \pi^- \phi p$	OCCUR=2
1018.9	±0.6	800	COHEN	77	ASPK	6 $\pi^\pm N \rightarrow K^+ K^- N$	
1019.7	±0.5	454	KALBFLEISCH	76	HBC	2.18 $K^- p \rightarrow \Lambda K \bar{K}$	
1019.4	±0.8	984	BESCH	74	CNTR	2 $\gamma p \rightarrow p K^+ K^-$	
1020.3	±0.4	100	BALLAM	73	HBC	2.8-9.3 γp	
1019.4	±0.7		BINNIE	73B	CNTR	$\pi^- p \rightarrow \phi n$	
1019.6	±0.5	120	¹⁹ AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow \Lambda K^+ K^-$	OCCUR=2
1019.9	±0.5	100	¹⁹ AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow K^- p K^+ K^-$	
1020.4	±0.5	131	COLLEY	72	HBC	10 $K^+ p \rightarrow K^+ p \phi$	
1019.9	±0.3	410	STOTTLE...	71	HBC	2.9 $K^- p \rightarrow \Sigma / \Lambda K \bar{K}$	

- ¹ From a fit of the cross section in the energy region $1.000 < \sqrt{s} < 1.100$ GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit. NODE=M004M;LINKAGE=Q
- ² Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results. NODE=M004M;LINKAGE=G
- ³ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$. NODE=M004M;LINKAGE=E
- ⁴ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. NODE=M004M;LINKAGE=C
- ⁵ Update of AKHMETSHIN 99D NODE=M004M;LINKAGE=GS
- ⁶ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta \gamma$ decays modes and using ACHASOV 00B for the $\eta \gamma$ decay mode. NODE=M004M;LINKAGE=AE
- ⁷ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included. NODE=M004M;LINKAGE=G2
- ⁸ Using a total width of 4.43 ± 0.05 MeV. NODE=M004M;LINKAGE=F2
- ⁹ PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74. NODE=M004M;LINKAGE=R
- ¹⁰ From the fit to data of CMD3, BABAR and BES3. NODE=M004M;LINKAGE=P
- ¹¹ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated. NODE=M004M;LINKAGE=O
- ¹² Width fixed at 4.2 MeV. NODE=M004M;LINKAGE=J
- ¹³ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 1019.457 ± 0.020 MeV. NODE=M004M;LINKAGE=M
- ¹⁴ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUE 18. NODE=M004M;LINKAGE=I
- ¹⁵ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. NODE=M004M;LINKAGE=N
- ¹⁶ Strongly correlated with AKHMETSHIN 04. NODE=M004M;LINKAGE=AH
- ¹⁷ Systematic errors not evaluated. NODE=M004M;LINKAGE=A
- ¹⁸ Weighted and scaled average of 12 measurements of DIJKSTRA 86. NODE=M004M;LINKAGE=B
- ¹⁹ Mass errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass. NODE=M004M;LINKAGE=D

ϕ(1020) WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT		
4.249 ± 0.013 OUR AVERAGE		Error includes scale factor of 1.1.				
4.212 ± 0.20 ± 0.13	1.28M	¹ ACHASOV	24	SND	$e^+ e^- \rightarrow K_L^0 K_S^0$	
4.245 ± 0.013	2.3M	² KOZYREV	18	CMD3	$e^+ e^- \rightarrow K^+ K^-$, $K_S^0 K_L^0$	OCCUR=2
4.205 ± 0.103 ± 0.067	28k	³ LEES	14H	BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \gamma$	
4.29 ± 0.04 ± 0.07		⁴ LEES	13Q	BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$	
4.30 ± 0.06 ± 0.17	105k	AKHMETSHIN	06	CMD2	0.98-1.06 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	
4.280 ± 0.033 ± 0.025	272k	⁵ AKHMETSHIN	04	CMD2	$e^+ e^- \rightarrow K_L^0 K_S^0$	
4.21 ± 0.04	1900k	⁶ ACHASOV	01E	SND	$e^+ e^- \rightarrow K^+ K^-$, $K_S K_L, \pi^+ \pi^- \pi^0$	
4.44 ± 0.09	55600	AKHMETSHIN	95	CMD2	$e^+ e^- \rightarrow$ hadrons	
4.5 ± 0.7	1500	ARENTON	82	AEMS	11.8 polar. $pp \rightarrow KK$	
4.2 ± 0.6	766	⁷ IVANOV	81	OLYA	1-1.4 $e^+ e^- \rightarrow K^+ K^-$	
4.3 ± 0.6		⁷ CORDIER	80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	
4.36 ± 0.29	3681	⁷ BUKIN	78C	OLYA	$e^+ e^- \rightarrow$ hadrons	
4.4 ± 0.6	984	⁷ BESCH	74	CNTR	2 $\gamma p \rightarrow p K^+ K^-$	
4.67 ± 0.72	681	⁷ BALAKIN	71	OSPK	$e^+ e^- \rightarrow$ hadrons	
4.09 ± 0.29		BIZOT	70	OSPK	$e^+ e^- \rightarrow$ hadrons	

NODE=M004W

NODE=M004W

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.151±0.018		⁸ DUBNICKA	24	RVUE	$e^+e^- \rightarrow K^+K^-$, $K_S^0 K_L^0$
4.681±0.277	34M	⁹ IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
4.07 ±0.13 ±0.01		¹⁰ HOID	20	RVUE	$e^+e^- \rightarrow \pi^0\gamma$
4.23 ±0.04 ±0.02		¹¹ HOFERICH...	19	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.249±0.015	1.7M	KOZYREV	18	CMD3	$e^+e^- \rightarrow K^+K^-$
4.240±0.017	610k	KOZYREV	16	CMD3	$e^+e^- \rightarrow K_S^0 K_L^0$
4.37 ±0.02		LEES	13F	BABR	$D^+ \rightarrow K^+K^-\pi^+$
4.24 ±0.02 ±0.03	542k	¹² AKHMETSHIN	08	CMD2	$1.02 e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	¹³ AUBERT,B	05J	BABR	$D^0 \rightarrow \bar{K}^0 K^+ K^-$
4.45 ±0.06	271k	DIJKSTRA	86	SPEC	$100 \pi^- \text{Be}$
3.6 ±0.8	337	⁷ COOPER	78B	HBC	$0.7-0.8 \bar{p}p \rightarrow$ $K_S^0 K_L^0 \pi^+ \pi^-$
4.5 ±0.50	1300	^{7,13} AKERLOF	77	SPEC	$400 pA \rightarrow K^+ K^- X$
4.5 ±0.8	500	^{7,13} AYRES	74	ASPK	$3-6 \pi^- p \rightarrow$ $K^+ K^- n, K^- p \rightarrow$ $K^+ K^- \Lambda / \Sigma^0$
3.81 ±0.37		COSME	74B	OSPK	$e^+e^- \rightarrow K_L^0 K_S^0$
3.8 ±0.7	454	⁷ BORENSTEIN	72	HBC	$2.18 K^- p \rightarrow K \bar{K} n$

¹ From a fit of the cross section in the energy region $1.000 < \sqrt{s} < 1.100$ GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit.

² Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.

³ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

⁴ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.

⁵ Update of AKHMETSHIN 99D

⁶ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

⁷ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁸ From the fit to data of CMD3, BABAR and BES3.

⁹ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. Systematic errors not estimated.

¹⁰ The values were extracted from a dispersively improved Breit-Wigner parameterization.

¹¹ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.

¹² Strongly correlated with AKHMETSHIN 04.

¹³ Systematic errors not evaluated.

NODE=M004W;LINKAGE=N

NODE=M004W;LINKAGE=G

NODE=M004W;LINKAGE=E

NODE=M004W;LINKAGE=C

NODE=M004W;LINKAGE=GS

NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D

NODE=M004W;LINKAGE=M

NODE=M004W;LINKAGE=L

NODE=M004W;LINKAGE=I

NODE=M004W;LINKAGE=K

NODE=M004W;LINKAGE=AH

NODE=M004W;LINKAGE=A

$\phi(1020)$ DECAY MODES

NODE=M004215;NODE=M004

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 K^+K^-	(49.9 ±0.5)%	S=1.5
Γ_2 $K_L^0 K_S^0$	(33.6 ±0.4)%	S=1.3
Γ_3 $\rho\pi + \pi^+\pi^-\pi^0$	(14.9 ±0.4)%	S=1.3
Γ_4 $\pi^+\pi^-\pi^0$		
Γ_5 $\eta\gamma$	(1.306±0.024)%	S=1.2
Γ_6 $\pi^0\gamma$	(1.33 ±0.05) × 10 ⁻³	
Γ_7 $\ell^+\ell^-$	—	
Γ_8 e^+e^-	(2.964±0.033) × 10 ⁻⁴	S=1.4
Γ_9 $\mu^+\mu^-$	(2.86 ±0.22) × 10 ⁻⁴	S=1.2
Γ_{10} ηe^+e^-	(1.08 ±0.04) × 10 ⁻⁴	
Γ_{11} $\pi^+\pi^-$	(9.5 ±1.9) × 10 ⁻⁵	S=2.0
Γ_{12} $\omega\pi^0$	(4.7 ±0.5) × 10 ⁻⁵	
Γ_{13} $\omega\gamma$	< 5 %	CL=84%
Γ_{14} $\rho\gamma$	< 1.2 × 10 ⁻⁵	CL=90%
Γ_{15} $\pi^+\pi^-\gamma$	(4.1 ±1.3) × 10 ⁻⁵	

DESIG=1

DESIG=2

DESIG=24

DESIG=3

DESIG=4

DESIG=7

DESIG=256;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=6

DESIG=17

DESIG=8

DESIG=25

DESIG=10

DESIG=12

DESIG=9

Γ_{16}	$f_0(980)\gamma$	$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1	DESIG=20
Γ_{17}	$\pi^0\pi^0\gamma$	$(1.13 \pm 0.06) \times 10^{-4}$		DESIG=19
Γ_{18}	$\pi^+\pi^-\pi^+\pi^-$	$(3.9 \pm_{-2.2}^{+2.8}) \times 10^{-6}$		DESIG=15
Γ_{19}	$\pi^+\pi^+\pi^-\pi^-\pi^0$	$< 4.6 \times 10^{-6}$	CL=90%	DESIG=14
Γ_{20}	$\pi^0e^+e^-$	$(1.33 \pm_{-0.10}^{+0.07}) \times 10^{-5}$		DESIG=21
Γ_{21}	$\pi^0\eta\gamma$	$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5	DESIG=22
Γ_{22}	$a_0(980)\gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		DESIG=23
Γ_{23}	$K^0\bar{K}^0\gamma$	$< 1.9 \times 10^{-8}$	CL=90%	DESIG=257
Γ_{24}	$\eta'(958)\gamma$	$(6.23 \pm 0.21) \times 10^{-5}$		DESIG=194
Γ_{25}	$\eta\pi^0\pi^0\gamma$	$< 2 \times 10^{-5}$	CL=90%	DESIG=195
Γ_{26}	$\mu^+\mu^-\gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		DESIG=196
Γ_{27}	$\rho\gamma\gamma$	$< 1.2 \times 10^{-4}$	CL=90%	DESIG=250
Γ_{28}	$\eta\pi^+\pi^-$	$< 1.8 \times 10^{-5}$	CL=90%	DESIG=255
Γ_{29}	$\eta\mu^+\mu^-$	$< 9.4 \times 10^{-6}$	CL=90%	DESIG=26
Γ_{30}	$\eta U \rightarrow \eta e^+e^-$	$< 1 \times 10^{-6}$	CL=90%	DESIG=259
Γ_{31}	invisible	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=260
Lepton Family number (LF) violating modes				
Γ_{32}	$e^\pm\mu^\mp$	LF $< 2 \times 10^{-6}$	CL=90%	NODE=M004;CLUMP=A DESIG=258

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 83 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 89.3$ for 70 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-74									
x_3	-67	0								
x_5	-26	27	3							
x_6	-15	17	2	8						
x_8	64	-77	-9	-36	-22					
x_9	-6	7	1	3	2	-9				
x_{11}	-4	4	0	2	1	-6	1			
x_{12}	-5	6	1	3	2	-8	1	0		
x_{16}	0	0	0	0	0	0	0	0	0	
x_{17}	-13	15	2	18	4	-19	2	1	2	0
x_{18}	-1	1	0	1	0	-2	0	0	0	0
x_{22}	0	0	0	0	0	0	0	0	0	0
x_{24}	-8	9	1	32	3	-12	1	1	1	0
	x_1	x_2	x_3	x_5	x_6	x_8	x_9	x_{11}	x_{12}	x_{16}
x_{18}	0									
x_{22}	0	0								
x_{24}	6	0	0							
	x_{17}	x_{18}	x_{22}							

$\phi(1020)$ PARTIAL WIDTHS

NODE=M004218

 $\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M004W6
NODE=M004W6

••• We do not use the following data for averages, fits, limits, etc. •••

58.9 ± 0.5 ± 2.4	ACHASOV	00	SND	$e^+e^- \rightarrow \eta\gamma$
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$\Gamma(\pi^0\gamma)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M004W7
 NODE=M004W7

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.40 \pm 0.16^{+0.43}_{-0.40}$	ACHASOV	00	SND $e^+e^- \rightarrow \pi^0\gamma$
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 $\Gamma(\ell^+\ell^-)$ Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

NODE=M004W5
 NODE=M004W5

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.320 \pm 0.017 \pm 0.015$	¹ AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow \mu^+\mu^-$
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¹Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.

NODE=M004W5;LINKAGE=AM

 $\Gamma(e^+e^-)$ Γ_8

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M004W8
 NODE=M004W8

1.27 ± 0.04 OUR EVALUATION**1.251 ± 0.021 OUR AVERAGE** Error includes scale factor of 1.1.

$1.235 \pm 0.006 \pm 0.022$	¹ AKHMETSHIN	11	CMD2 $1.02 e^+e^- \rightarrow \phi$
$1.32 \pm 0.05 \pm 0.03$	² AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow e^+e^-$
1.28 ± 0.05	AKHMETSHIN	95	CMD2 $1.02 e^+e^- \rightarrow \phi$

→ UNCHECKED ←

¹Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

²From forward-backward asymmetry and using $\Gamma_{\text{total}} = 4.26 \pm 0.05$ MeV from the 2004 edition of this Review.

NODE=M004W8;LINKAGE=AK

NODE=M004W8;LINKAGE=AM

 $(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{\frac{1}{2}}$ $(\Gamma_8\Gamma_9)^{\frac{1}{2}}$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M004W9
 NODE=M004W9

1.320 ± 0.018 ± 0.017	AMBROSINO	05	KLOE $1.02 e^+e^- \rightarrow \mu^+\mu^-$
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 $\phi(1020) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M004223

 $\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M004G01
 NODE=M004G01

0.6340 ± 0.0070 ± 0.0039		¹ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.669 \pm 0.001 \pm 0.023$	1.7M	KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-$
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NODE=M004G01;LINKAGE=A

¹Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. The first error combines statistical and systematic uncertainties. The second one is due to the parametrization of the charged kaon form factor and mass calibration.

 $\Gamma(K_L^0 K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

NODE=M004GXX
 NODE=M004GXX

0.4200 ± 0.0033 ± 0.0123	28k	¹ LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
---------------------------------	-----	-------------------	-----	--

¹Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

NODE=M004GXX;LINKAGE=A

 $[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)] \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_8/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M004R03
 NODE=M004R03

184.1 ± 2.1 ± 8.0	¹ LEES	21B	BABR $10.5 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
--------------------------	-------------------	-----	--

¹From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

NODE=M004R03;LINKAGE=A

 $\phi(1020) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M004224

 $\Gamma(K^+K^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M004G10
 NODE=M004G10

14.79 ± 0.30 OUR FIT Error includes scale factor of 1.5. $[(14.64 \pm 0.27) \times 10^{-5}]$ OUR 2024 FIT Scale factor = 1.4]

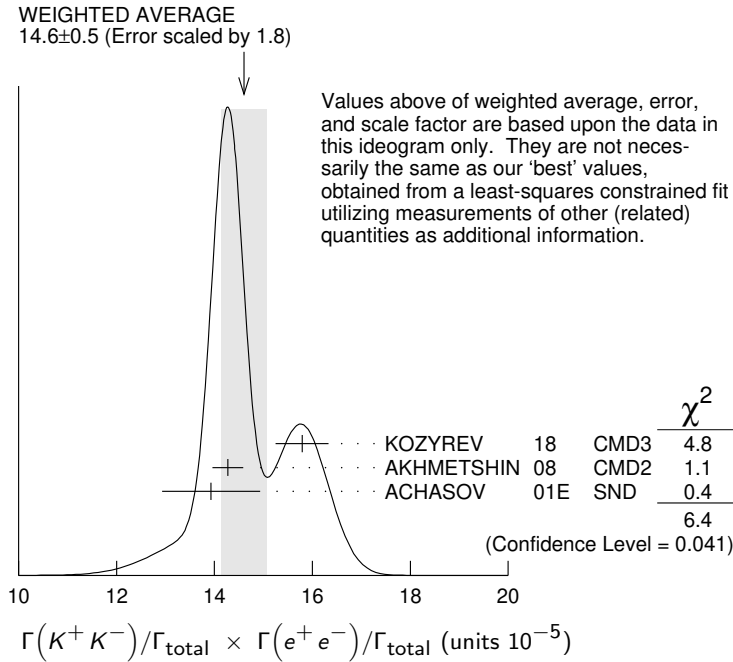
NEW

14.6 ± 0.5 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.

15.789 ± 0.541	1.7M	KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-$
$14.27 \pm 0.05 \pm 0.31$	542k	AKHMETSHIN	08	CMD2 $1.02 e^+e^- \rightarrow K^+K^-$
$13.93 \pm 0.14 \pm 0.99$	1000k	¹ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

NODE=M004G10;LINKAGE=AE



$\Gamma(K_L^0 K_S^0)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$		$\Gamma_2/\Gamma \times \Gamma_8/\Gamma$	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN
9.97 ± 0.08 OUR FIT			
[(10.11 ± 0.12) × 10 ⁻⁵ OUR 2024 FIT]			
9.94 ± 0.08 OUR AVERAGE			
[(10.07 ± 0.13) × 10 ⁻⁵ OUR 2024 AVERAGE]			
9.85 ± 0.03 ± 0.10	1.28M	1 ACHASOV	24 SND
10.078 ± 0.223	610k	2 KOZYREV	16 CMD3
10.01 ± 0.04 ± 0.17	272k	3 AKHMETSHIN	04 CMD2
10.27 ± 0.07 ± 0.34	500k	4 ACHASOV	01E SND

$e^+e^- \rightarrow K_L^0 K_S^0$
 $e^+e^- \rightarrow K_S^0 K_L^0$
 $e^+e^- \rightarrow K_L^0 K_S^0$
 $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$

NODE=M004G6
NODE=M004G6
NEW
NEW

¹ From a fit of the cross section in the energy region $1.000 < \sqrt{s} < 1.100$ GeV using a vector meson dominance model with contribution from $\phi(1020)$, $\rho(770)$, $\omega(782)$ and higher vector resonances. The the first three points near the threshold are removed in the fit.
² KOZYREV 16 also reports $\Gamma(e^+e^-) B(\phi \rightarrow K_S^0 K_L^0) = (0.428 \pm 0.001 \pm 0.009)$ keV.
³ Update of AKHMETSHIN 99D
⁴ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

NODE=M004G6;LINKAGE=B
NODE=M004G6;LINKAGE=A
NODE=M004G;LINKAGE=GS
NODE=M004G6;LINKAGE=AE

$[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)]/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$		$\Gamma_3/\Gamma \times \Gamma_8/\Gamma$	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN
4.42 ± 0.11 OUR FIT			
Error includes scale factor of 1.2. [(4.58 ± 0.11) × 10 ⁻⁵ OUR 2024 FIT Scale factor = 1.1]			
4.51 ± 0.14 OUR AVERAGE			
4.51 ± 0.16 ± 0.11	105k	AKHMETSHIN 06	CMD2
4.665 ± 0.042 ± 0.261	400k	1 ACHASOV	01E SND
4.35 ± 0.27 ± 0.08	11169	2 AKHMETSHIN 98	CMD2
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
4.38 ± 0.12		BENAYOUN 10	RVUE
4.30 ± 0.08 ± 0.21		3 AUBERT,B	04N BABR

$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
 $e^+e^- \rightarrow K^+K^-, K_S K_L, \pi^+\pi^-\pi^0$
 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M004G7
NODE=M004G7
NEW

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.
² Recalculated by us from the cross section in the peak.
³ Superseded by LEES 21B.

NODE=M004G7;LINKAGE=AE
NODE=M004G;LINKAGE=B
NODE=M004G7;LINKAGE=A

$$\Gamma(\eta\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

3.87 ± 0.07 OUR FIT Error includes scale factor of 1.2. $[(3.88 \pm 0.07) \times 10^{-6}]$ OUR
2024 FIT Scale factor = 1.2]

3.93 ± 0.09 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

4.050 ± 0.067 ± 0.118 33k ¹ ACHASOV 07B SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

4.093^{+0.040}_{-0.043} ± 0.247 17.4k ² AKHMETSHIN 05 CMD2 0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

3.850 ± 0.041 ± 0.159 23k ^{3,4} AKHMETSHIN 01B CMD2 $e^+e^- \rightarrow \eta\gamma$

4.00 ± 0.04 ± 0.11 ⁵ ACHASOV 00 SND $e^+e^- \rightarrow \eta\gamma$

3.53 ± 0.08 ± 0.17 2200 ^{6,7} AKHMETSHIN 99F CMD2 $e^+e^- \rightarrow \eta\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.19 ± 0.06 ⁸ BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.

² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.

⁶ Recalculated by the authors from the cross section in the peak.

⁷ From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.

⁸ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M004G2
NODE=M004G2

NEW

NODE=M004G2;LINKAGE=AH

NODE=M004G2;LINKAGE=AK

NODE=M004G;LINKAGE=AK

NODE=M004G;LINKAGE=BQ

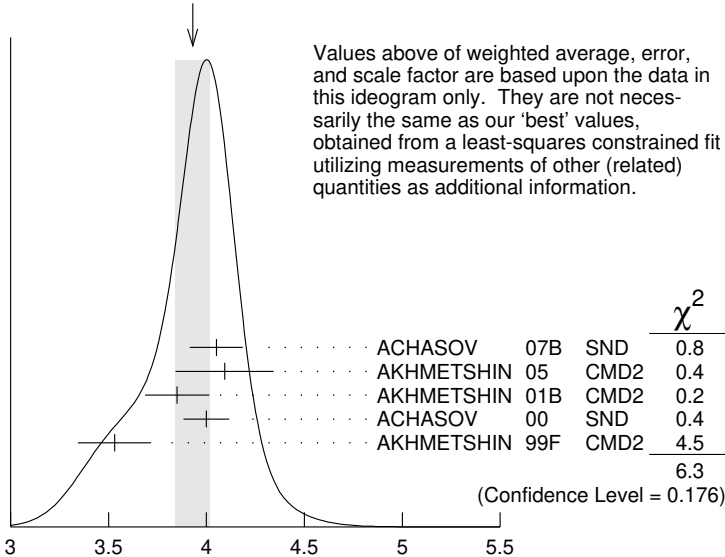
NODE=M004G2;LINKAGE=A

NODE=M004G;LINKAGE=A

NODE=M004G2;LINKAGE=C

NODE=M004G7;LINKAGE=BE

WEIGHTED AVERAGE
3.93±0.09 (Error scaled by 1.3)



$$\Gamma(\eta\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma \times \Gamma_8/\Gamma$$

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

3.94 ± 0.16 OUR FIT

3.95 ± 0.17 OUR AVERAGE

4.04 ± 0.09 ± 0.19 ¹ ACHASOV 16A SND 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

3.75 ± 0.11 ± 0.29 18k ² AKHMETSHIN 05 CMD2 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.29 ± 0.11 ² BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

3.67 ± 0.10^{+0.27}_{-0.25} ³ ACHASOV 00 SND $e^+e^- \rightarrow \pi^0\gamma$

¹ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 00.

² A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

³ From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.

NODE=M004G3
NODE=M004G3

NODE=M004G3;LINKAGE=B

NODE=M004G3;LINKAGE=BE

NODE=M004G3;LINKAGE=A

$\Gamma(\mu^+\mu^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_9/\Gamma \times \Gamma_8/\Gamma$

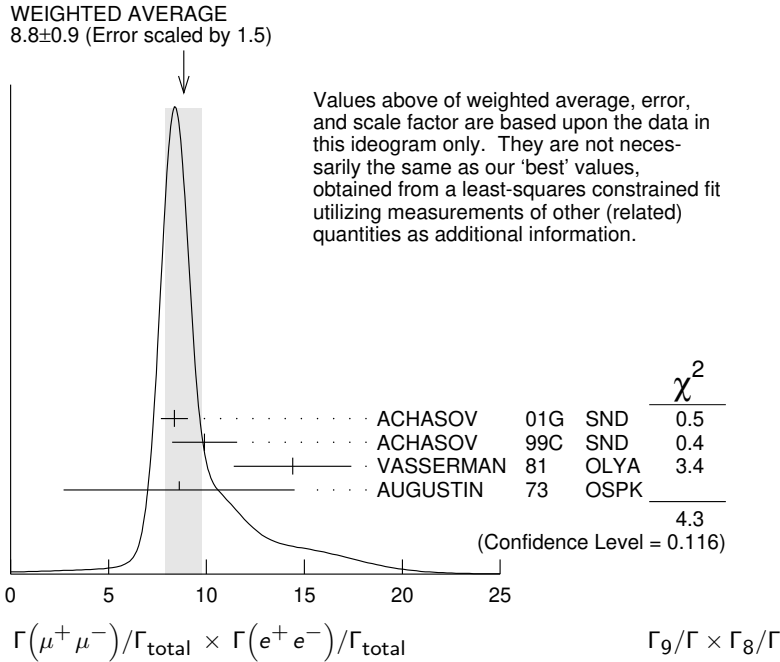
VALUE (units 10^{-8}) DOCUMENT ID TECN COMMENT

8.5 ±0.6 OUR FIT	Error includes scale factor of 1.2.		
8.8 ±0.9 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
8.36 ±0.59 ±0.37	ACHASOV	01G	SND $e^+e^- \rightarrow \mu^+\mu^-$
9.9 ±1.4 ±0.9	¹ ACHASOV	99C	SND $e^+e^- \rightarrow \mu^+\mu^-$
14.4 ±3.0	² VASSERMAN	81	OLYA $e^+e^- \rightarrow \mu^+\mu^-$
8.6 ±5.9	² AUGUSTIN	73	OSPK $e^+e^- \rightarrow \mu^+\mu^-$

¹ Recalculated by the authors from the cross section in the peak.
² Recalculated by us from the cross section in the peak.

NODE=M004G5
 NODE=M004G5

NODE=M004G5;LINKAGE=A
 NODE=M004G5;LINKAGE=B



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$\Gamma(\pi^+\pi^-)/\Gamma_{total} \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{11}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8}) EVTS DOCUMENT ID TECN COMMENT

2.8 ±0.6 OUR FIT	Error includes scale factor of 2.0. [(2.2 ± 0.4) × 10 ⁻⁸ OUR 2024 FIT]		
2.8 ±0.5 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below. [(2.2 ± 0.4) × 10 ⁻⁸ OUR 2024 AVERAGE]		
3.51 ±0.33 ±0.24	34M	¹ IGNATOV	24 CMD3 $e^+e^- \rightarrow \pi^+\pi^-$
2.1 ±0.3 ±0.3		² ACHASOV	00C SND $e^+e^- \rightarrow \pi^+\pi^-$
1.95 ^{+1.15} _{-0.87}		³ GOLUBEV	86 ND $e^+e^- \rightarrow \pi^+\pi^-$
6.01 ^{+3.19} _{-2.51}		³ VASSERMAN	81 OLYA $e^+e^- \rightarrow \pi^+\pi^-$
3.31 ±0.99		⁴ BENAYOUN	13 RVUE 0.4–1.05 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a fit of the pion form factor in the energy range $0.32 < \sqrt{s} < 1.2$ GeV using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference with ω and ϕ masses and widths constrained by the values and their errors from PDG 22, and leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. A fit without the constraints from PDG 22 gives a value $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-)/\Gamma_{total}^2 = (3.65 \pm 0.24) \times 10^{-8}$.
² Recalculated by the authors from the cross section in the peak.
³ Recalculated by us from the cross section in the peak.
⁴ A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma, K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data.

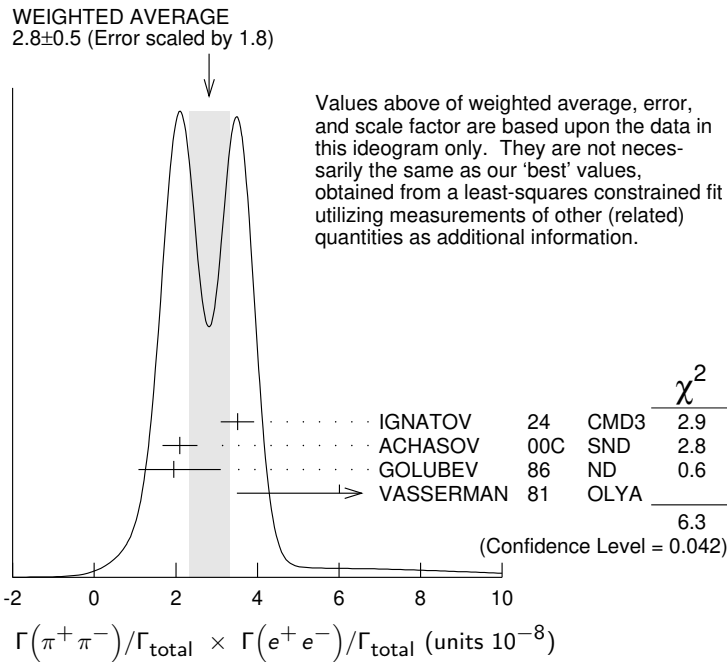
NODE=M004G4
 NODE=M004G4

NEW

NEW

NODE=M004G4;LINKAGE=C

NODE=M004G4;LINKAGE=AC
 NODE=M004G4;LINKAGE=B
 NODE=M004G4;LINKAGE=A



$$\Gamma(\omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
1.40±0.15 OUR FIT			

NODE=M004G11
NODE=M004G11

1.37±0.17±0.01 ^{1,2} AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

¹ Recalculated by the authors from the cross section at the peak.

² AMBROSINO 08G reports $[\Gamma(\phi(1020) \rightarrow \omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(\phi(1020) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = (1.22 \pm 0.13 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M004G11;LINKAGE=AB
NODE=M004G11;LINKAGE=AM

$$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
3.34±0.17 OUR FIT			

NODE=M004G9
NODE=M004G9

3.33^{+0.04+0.19}_{-0.09-0.20} ¹ AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ Calculated by the authors from the cross section at the peak.

NODE=M004G9;LINKAGE=AM

$$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2^{+0.8}_{-0.7} OUR FIT				

NODE=M004G8
NODE=M004G8

1.17±0.52±0.64 3285 ¹ AKHMETSHIN 00E CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

¹ Recalculated by the authors from the cross section in the peak.

NODE=M004G8;LINKAGE=A

$\phi(1020)$ BRANCHING RATIOS

NODE=M004220

$$\Gamma(K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.499±0.005 OUR FIT				Error includes scale factor of 1.5. [0.491±0.005 OUR 2024 FIT

NODE=M004R1
NODE=M004R1
NEW

Scale factor = 1.3]

0.493±0.010 OUR AVERAGE

0.492±0.012	2913	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K^+K^-$
0.44 ±0.05	321	KALBFLEISCH 76	HBC	$2.18 K^-p \rightarrow \Lambda K^+K^-$
0.49 ±0.06	270	DEGROOT 74	HBC	$4.2 K^-p \rightarrow \Lambda\phi$
0.540±0.034	565	BALAKIN 71	OSPK	$e^+e^- \rightarrow K^+K^-$
0.48 ±0.04	252	LINDSEY 66	HBC	$2.1-2.7 K^-p \rightarrow \Lambda K^+K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.493±0.003±0.007		¹ AKHMETSHIN 11	CMD2	$1.02 e^+e^- \rightarrow K^+K^-$
0.476±0.017	1000k	² ACHASOV 01E	SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$

¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

NODE=M004R1;LINKAGE=AK

² Using $B(\phi \rightarrow e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

NODE=M004R1;LINKAGE=B2

$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT
0.336±0.004 OUR FIT Error includes scale factor of 1.3. [0.339±0.004 OUR 2024 FIT
 Scale factor = 1.2]

NODE=M004R2
 NODE=M004R2
 NEW

0.331±0.009 OUR AVERAGE

0.335±0.010 40644 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow K_L^0 K_S^0$
 0.326±0.035 DOLINSKY 91 ND $e^+e^- \rightarrow K_L^0 K_S^0$
 0.310±0.024 DRUZHININ 84 ND $e^+e^- \rightarrow K_L^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.336±0.002±0.006 ¹ AKHMETSHIN 11 CMD2 1.02 $e^+e^- \rightarrow K_S^0 K_L^0$
 0.351±0.013 500k ² ACHASOV 01E SND $e^+e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$
 0.27 ±0.03 133 KALBFLEISCH 76 HBC 2.18 $K^- p \rightarrow \Lambda K_L^0 K_S^0$
 0.257±0.030 95 ³ BALAKIN 71 OSPK $e^+e^- \rightarrow K_L^0 K_S^0$
 0.40 ±0.04 167 LINDSEY 66 HBC 2.1-2.7 $K^- p \rightarrow \Lambda K_L^0 K_S^0$

¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0, \eta \gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

² Using $B(\phi \rightarrow e^+ e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

³ Balakin error increased by Paul.

NODE=M004R2;LINKAGE=AK

NODE=M004R2;LINKAGE=B2
 NODE=M004R2;LINKAGE=01

 $\Gamma(K_L^0 K_S^0)/\Gamma(K^+ K^-)$ Γ_2/Γ_1

VALUE EVTS DOCUMENT ID TECN COMMENT
0.674±0.014 OUR FIT Error includes scale factor of 1.4. [0.690±0.014 OUR 2024 FIT
 Scale factor = 1.3]

NODE=M004R19
 NODE=M004R19
 NEW

0.740±0.031 OUR AVERAGE

0.70 ±0.06 2732 BUKIN 78C OLYA $e^+e^- \rightarrow K_L^0 K_S^0$
 0.82 ±0.08 LOSTY 78 HBC 4.2 $K^- p \rightarrow \phi$ hyperon
 0.71 ±0.05 LAVEN 77 HBC 10 $K^- p \rightarrow K^+ K^- \Lambda$
 0.71 ±0.08 LYONS 77 HBC 3-4 $K^- p \rightarrow \Lambda \phi$
 0.89 ±0.10 144 AGUILAR-... 72B HBC 3.9,4.6 $K^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.644±0.017 ¹ DUBNICKA 24 RVUE $e^+e^- \rightarrow K^+ K^-, K_S^0 K_L^0$
 0.638±0.022 2.3M ² KOZYREV 18 CMD3 $e^+e^- \rightarrow K_L^0 K_S^0, K^+ K^-$
 0.68 ±0.03 ³ AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow K_L^0 K_S^0, K^+ K^-$

¹ From a fit to CMD3, BABAR and BES3 data.

² The prediction taking into account phase-space difference, radiative corrections, isospin breaking, and the Sommerfeld-Gamow-Sakharov factor gives 0.630.

³ Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FIS-CHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYNSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

NODE=M004R19;LINKAGE=B
 NODE=M004R19;LINKAGE=A

NODE=M004R19;LINKAGE=KH

 $\Gamma(K_L^0 K_S^0)/\Gamma(K \bar{K})$ $\Gamma_2/(\Gamma_1+\Gamma_2)$

VALUE EVTS DOCUMENT ID TECN COMMENT
0.403±0.005 OUR FIT Error includes scale factor of 1.4. [0.408±0.005 OUR 2024 FIT
 Scale factor = 1.3]

NODE=M004R5
 NODE=M004R5
 NEW

0.45 ±0.04 OUR AVERAGE

0.44 ±0.07 ¹ LONDON 66 HBC 2.24 $K^- p \rightarrow \Lambda K \bar{K}$
 0.48 ±0.07 52 BADIER 65B HBC 3 $K^- p$
 0.40 ±0.10 34 SCHLEIN 63 HBC 1.95 $K^- p \rightarrow \Lambda K \bar{K}$

¹ This is probably not affected by their controversial background subtraction; the value is from their numbers of $K_1 K_2$ vs $K^+ K^-$ events.

NODE=M004R5;LINKAGE=01

 $[\Gamma(\rho \pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT
0.149±0.004 OUR FIT Error includes scale factor of 1.3. [0.154±0.004 OUR 2024 FIT
 Scale factor = 1.2]

NODE=M004R3
 NODE=M004R3
 NEW

0.151±0.009 OUR AVERAGE Error includes scale factor of 1.7.

0.161±0.008 11761 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
 0.143±0.007 DOLINSKY 91 ND $e^+e^- \rightarrow \pi^+ \pi^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.155±0.002±0.005 ¹ AKHMETSHIN 11 CMD2 1.02 $e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
 0.159±0.008 400k ² ACHASOV 01E SND $e^+e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$
 0.145±0.009±0.003 ³ AKHMETSHIN 98 CMD2 $e^+e^- \rightarrow \pi^+ \pi^- \pi^0$
 0.139±0.007 ⁴ PARROUR 76B OSPK e^+e^-

¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0, \eta \gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

² Using $B(\phi \rightarrow e^+ e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

³ Using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁴ Using $\Gamma(\phi) = 4.1$ MeV. If interference between the $\rho\pi$ and 3π modes is neglected, the fraction of the $\rho\pi$ is more than 80% at the 90% confidence level.

NODE=M004R3;LINKAGE=AK

NODE=M004R3;LINKAGE=B2

NODE=M004R;LINKAGE=8D

NODE=M004R3;LINKAGE=E

$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)] / \Gamma(K^+ K^-)$ Γ_3/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.299±0.010 OUR FIT				Error includes scale factor of 1.4. [0.313±0.010 OUR 2024 FIT Scale factor = 1.2]

NODE=M004R20
NODE=M004R20

NEW

0.232±0.017 OUR AVERAGE

[0.28 ± 0.09 OUR 2024 AVERAGE]

NEW

0.230±0.014±0.010 ABLIKIM 25A BES3 $D_S^+ \rightarrow \phi \pi^+$ 0.28 ± 0.09 34 AGUILAR-... 72B HBC 3.9,4.6 $K^- p$

$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)] / \Gamma(K \bar{K})$ $\Gamma_3/(\Gamma_1+\Gamma_2)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.178±0.005 OUR FIT			Error includes scale factor of 1.3. [0.185±0.005 OUR 2024 FIT Scale factor = 1.2]

NODE=M004R6
NODE=M004R6

NEW

0.24 ± 0.04 OUR AVERAGE

0.237±0.039 CERRADA 77B HBC 4.2 $K^- p \rightarrow \Lambda 3\pi$ 0.30 ± 0.15 LONDON 66 HBC 2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^- \pi^0$

$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)] / \Gamma(K_L^0 K_S^0)$ Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.443±0.012 OUR FIT				Error includes scale factor of 1.2. [0.453±0.012 OUR 2024 FIT Scale factor = 1.1]

NODE=M004R7
NODE=M004R7

NEW

0.51 ± 0.05 OUR AVERAGE

0.56 ± 0.07 3681 BUKIN 78C OLYA $e^+ e^- \rightarrow K_L^0 K_S^0, \pi^+ \pi^- \pi^0$ 0.47 ± 0.06 516 COSME 74 OSPK $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

$\Gamma(\pi^+ \pi^- \pi^0) / \Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M004R46
NODE=M004R46

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

≈ 0.0087 1.98M ^{1,2} ALOISIO 03 KLOE 1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$ < 0.0006 90 ³ ACHASOV 02 SND 1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$ < 0.23 90 ³ CORDIER 80 DM1 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$ < 0.20 90 ³ PARROUR 76B OSPK $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$ ¹ From a fit without limitations on charged and neutral ρ masses and widths.² Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+ \pi^- \pi^0$.³ Neglecting the interference between the $\rho\pi$ and $\pi^+ \pi^- \pi^0$.

NODE=M004R;LINKAGE=L1

NODE=M004R;LINKAGE=L2

NODE=M004R;LINKAGE=46

$\Gamma(\eta\gamma) / \Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.306±0.024 OUR FIT				Error includes scale factor of 1.2. [(1.301±0.024) × 10 ⁻² OUR 2024 FIT Scale factor = 1.2]

NODE=M004R11
NODE=M004R11

NEW

1.26 ± 0.04 OUR AVERAGE

1.246±0.025±0.057 10k ¹ ACHASOV 98F SND $e^+ e^- \rightarrow 7\gamma$ 1.18 ± 0.11 279 ² AKHMETSHIN 95 CMD2 $e^+ e^- \rightarrow \pi^+ \pi^- 3\gamma$ 1.30 ± 0.06 ³ DRUZHININ 84 ND $e^+ e^- \rightarrow 3\gamma$ 1.4 ± 0.2 ⁴ DRUZHININ 84 ND $e^+ e^- \rightarrow 6\gamma$ 0.88 ± 0.20 290 KURDADZE 83C OLYA $e^+ e^- \rightarrow 3\gamma$ 1.35 ± 0.29 ANDREWS 77 CNTR 6.7-10 γCu 1.5 ± 0.4 54 ³ COSME 76 OSPK $e^+ e^-$

OCCUR=2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1.38 ± 0.02 ± 0.02 ⁵ AKHMETSHIN 11 CMD2 1.02 $e^+ e^- \rightarrow \eta\gamma$ 1.37 ± 0.05 ± 0.02 33k ⁶ ACHASOV 07B SND 0.6-1.38 $e^+ e^- \rightarrow \eta\gamma$ 1.373±0.014±0.085 17.4k ^{7,8} AKHMETSHIN 05 CMD2 0.60-1.38 $e^+ e^- \rightarrow \eta\gamma$ 1.287±0.013±0.063 ^{9,10} AKHMETSHIN 01B CMD2 $e^+ e^- \rightarrow \eta\gamma$ 1.338±0.012±0.052 ¹¹ ACHASOV 00 SND $e^+ e^- \rightarrow \eta\gamma$ 1.18 ± 0.03 ± 0.06 2200 ¹² AKHMETSHIN 99F CMD2 $e^+ e^- \rightarrow \eta\gamma$ 1.21 ± 0.07 ¹³ BENAYOUN 96 RVUE 0.54-1.04 $e^+ e^- \rightarrow \eta\gamma$

- ¹ Using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.
² From $\pi^+ \pi^- \pi^0$ decay mode of η .
³ From 2γ decay mode of η .
⁴ From $3\pi^0$ decay mode of η .
⁵ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .
⁶ ACHASOV 07B reports $[\Gamma(\phi(1020) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow e^+ e^-)] = (4.050 \pm 0.067 \pm 0.118) \times 10^{-6}$ which we divide by our best value $B(\phi(1020) \rightarrow e^+ e^-) = (2.964 \pm 0.033) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.
⁷ Using $B(\phi \rightarrow e^+ e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁸ Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
⁹ Using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
¹⁰ The combined fit from 600 to 1380 MeV taking into account $\rho(770), \omega(782), \phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
¹¹ From the $\eta \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
¹² From $\pi^+ \pi^- \pi^0$ decay mode of η and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.
¹³ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M004R11;LINKAGE=AC
 NODE=M004R11;LINKAGE=Z3
 NODE=M004R11;LINKAGE=A
 NODE=M004R11;LINKAGE=C
 NODE=M004R11;LINKAGE=AN

NODE=M004R11;LINKAGE=AO

NODE=M004R11;LINKAGE=AH
 NODE=M004R11;LINKAGE=AK
 NODE=M004R;LINKAGE=AK
 NODE=M004R;LINKAGE=BQ

NODE=M004R;LINKAGE=GA
 NODE=M004R;LINKAGE=FF
 NODE=M004R;LINKAGE=TS

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ
 VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

1.33 ± 0.05 OUR FIT

[(1.32 ± 0.05) × 10⁻³ OUR 2024 FIT]

1.31 ± 0.13 OUR AVERAGE

1.30 ± 0.13 DRUZHININ 84 ND $e^+ e^- \rightarrow 3\gamma$

1.4 ± 0.5 32 COSME 76 OSPK $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.367 ± 0.072 ¹ ACHASOV 16A SND 0.60-1.38 $e^+ e^- \rightarrow \pi^0\gamma$

1.258 ± 0.037 ± 0.077 18k ^{2,3} AKHMETSHIN 05 CMD2 0.60-1.38 $e^+ e^- \rightarrow \pi^0\gamma$

1.226 ± 0.036 ^{+0.096}_{-0.089} ⁴ ACHASOV 00 SND $e^+ e^- \rightarrow \pi^0\gamma$

1.26 ± 0.17 ⁵ BENAYOUN 96 RVUE 0.54-1.04 $e^+ e^- \rightarrow \pi^0\gamma$

¹ Using $B(\phi \rightarrow e^+ e^-)$ from PDG 15. Supersedes ACHASOV 00.

² Using $B(\phi \rightarrow e^+ e^-) = (2.98 \pm 0.04) \times 10^{-4}$.

³ Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.

⁴ From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁵ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M004R17
 NODE=M004R17

NEW

OCCUR=3

NODE=M004R17;LINKAGE=D
 NODE=M004R17;LINKAGE=AH
 NODE=M004R17;LINKAGE=AK
 NODE=M004R;LINKAGE=3G
 NODE=M004R17;LINKAGE=TS

$\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_5/Γ_6
 VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.9 ± 0.3 ^{+0.7}_{-0.8} ACHASOV 00 SND $e^+ e^- \rightarrow \eta\gamma, \pi^0\gamma$

NODE=M004R42
 NODE=M004R42

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_8/Γ
 VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.964 ± 0.033 OUR FIT Error includes scale factor of 1.4. [(2.979 ± 0.033) × 10⁻⁴ OUR 2024 FIT Scale factor = 1.2]

2.98 ± 0.07 OUR AVERAGE Error includes scale factor of 1.1.

2.93 ± 0.14 1900k ¹ ACHASOV 01E SND $e^+ e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$

2.88 ± 0.09 55600 AKHMETSHIN 95 CMD2 $e^+ e^- \rightarrow$ hadrons

3.00 ± 0.21 3681 BUKIN 78C OLYA $e^+ e^- \rightarrow$ hadrons

3.10 ± 0.14 ² PARROUR 76 OSPK $e^+ e^-$

3.3 ± 0.3 COSME 74 OSPK $e^+ e^- \rightarrow$ hadrons

2.81 ± 0.25 681 BALAKIN 71 OSPK $e^+ e^- \rightarrow$ hadrons

3.50 ± 0.27 CHATELUS 71 OSPK $e^+ e^-$

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

² Using total width 4.2 MeV. They detect 3π mode and observe significant interference with ω tail. This is accounted for in the result quoted above.

NODE=M004R16
 NODE=M004R16

NEW

NODE=M004R16;LINKAGE=AE

NODE=M004R16;LINKAGE=E

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-4})

DOCUMENT ID TECN COMMENT

2.86 ± 0.22 OUR FIT Error includes scale factor of 1.2. $[(2.85 \pm 0.22) \times 10^{-4}]$ OUR 2024 FIT Scale factor = 1.2]

NODE=M004R10
NODE=M004R10

NEW

2.96 ± 0.16 OUR AVERAGE Error includes scale factor of 1.1. $[(2.5 \pm 0.4) \times 10^{-4}]$ OUR 2024 AVERAGE]

NEW

2.69 ± 0.46 ¹ HAYES 71 CNTR 8.3,9.8 $\gamma C \rightarrow \mu^+\mu^- X$

2.17 ± 0.60 ¹ EARLES 70 CNTR 6.0 $\gamma C \rightarrow \mu^+\mu^- X$

• • • We use the following data for averages but not for fits. • • •

3.045 ± 0.049 ± 0.148 ² AAIJ 24B LHCB $D^+, D_s^+ \rightarrow \pi^+\phi$

NOTFITTED

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.87 ± 0.20 ± 0.14 ³ ACHASOV 01G SND $e^+e^- \rightarrow \mu^+\mu^-$

3.30 ± 0.45 ± 0.32 ⁴ ACHASOV 99C SND $e^+e^- \rightarrow \mu^+\mu^-$

4.83 ± 1.02 ⁵ VASSERMAN 81 OLYA $e^+e^- \rightarrow \mu^+\mu^-$

2.87 ± 1.98 ⁵ AUGUSTIN 73 OSPK $e^+e^- \rightarrow \mu^+\mu^-$

¹ Neglecting interference between resonance and continuum.

² Value not independent from the measurement of $B(\phi \rightarrow \mu^+\mu^-)/B(\phi \rightarrow e^+e^-)$.

³ Using $B(\phi \rightarrow e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.

⁴ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁵ Recalculated by us using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

NODE=M004R10;LINKAGE=A
NODE=M004R10;LINKAGE=B
NODE=M004R;LINKAGE=GZ
NODE=M004R10;LINKAGE=8D
NODE=M004R;LINKAGE=VA

 $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ Γ_9/Γ_8

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

1.022 ± 0.012 ± 0.048 24k AAIJ 24B LHCB $D^+, D_s^+ \rightarrow \pi^+\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.026 ± 0.020 ± 0.056 7.5k AAIJ 24B LHCB $D^+ \rightarrow \pi^+\phi$

OCCUR=2

1.017 ± 0.013 ± 0.051 16.7k AAIJ 24B LHCB $D_s^+ \rightarrow \pi^+\phi$

OCCUR=3

 $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.08 ± 0.04 OUR AVERAGE

1.075 ± 0.007 ± 0.038 30k ¹ BABUSCI 15 KLOE 1.02 $e^+e^- \rightarrow \eta e^+e^-$

1.19 ± 0.19 ± 0.12 213 ² ACHASOV 01B SND $e^+e^- \rightarrow \eta e^+e^-$

1.14 ± 0.10 ± 0.06 355 ³ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.13 ± 0.14 ± 0.07 183 ⁴ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$

OCCUR=2

1.21 ± 0.14 ± 0.09 130 ⁵ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$

OCCUR=3

1.04 ± 0.20 ± 0.08 42 ⁶ AKHMETSHIN 01 CMD2 $e^+e^- \rightarrow \eta e^+e^-$

OCCUR=4

1.3 $^{+0.8}_{-0.6}$ 7 GOLUBEV 85 ND $e^+e^- \rightarrow \eta e^+e^-$

¹ Using $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.23)\%$ from PDG 12.

² Using $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \rightarrow e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.

³ The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma, 3\pi^0, \pi^+\pi^-\pi^0$ decays.

⁴ From $\eta \rightarrow \gamma\gamma$ decays and using $B(\eta \rightarrow \gamma\gamma) = (39.33 \pm 0.25) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

NODE=M004R;LINKAGE=H2

⁵ From $\eta \rightarrow 3\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

NODE=M004R;LINKAGE=H3

⁶ From $\eta \rightarrow \pi^+\pi^-\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \rightarrow e^+e^-\gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \rightarrow \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

NODE=M004R;LINKAGE=H4

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.71 ± 0.11 ± 0.09 ¹ ACHASOV 00C SND $e^+e^- \rightarrow \pi^+\pi^-$

0.65 $^{+0.38}_{-0.29}$ ¹ GOLUBEV 86 ND $e^+e^- \rightarrow \pi^+\pi^-$

2.01 $^{+1.07}_{-0.84}$ ¹ VASSERMAN 81 OLYA $e^+e^- \rightarrow \pi^+\pi^-$

<6.6 95 BUKIN 78B OLYA $e^+e^- \rightarrow \pi^+\pi^-$

<2.7 95 ALVENSLEB... 72 CNTR 6.7 $\gamma C \rightarrow C\pi^+\pi^-$

¹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

NODE=M004R18
NODE=M004R18

NODE=M004R18;LINKAGE=8D

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

4.7±0.5 OUR FIT**5.2^{+1.3}_{-1.1}**1,2 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.4±0.6

3 AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

~ 5.4

4 ACHASOV 00E SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 5.5^{+1.6}_{-1.4}±0.32,5 AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ 4.8^{+1.9}_{-1.7}±0.84 ACHASOV 99 SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$ ¹ Using the 1996 and 1998 data.² (2.3 ± 0.3)% correction for other decay modes of the $\omega(782)$ applied.³ Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.⁴ Using the 1996 data.⁵ Using the 1998 data. Γ_{12}/Γ NODE=M004R28
NODE=M004R28

OCCUR=2

NODE=M004R28;LINKAGE=K2
NODE=M004R28;LINKAGE=K3
NODE=M004R28;LINKAGE=AM
NODE=M004R28;LINKAGE=VS
NODE=M004R28;LINKAGE=K1 $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$

VALUE CL%

DOCUMENT ID TECN COMMENT

<0.05

84

LINDSEY

66

HBC

2.1-2.7 $K^-p \rightarrow \Lambda\pi^+\pi^-$ neutrals Γ_{13}/Γ NODE=M004R14
NODE=M004R14 $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

DOCUMENT ID TECN COMMENT

< 0.12

90

¹ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 7

90

AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

<200

84

LINDSEY 66 HBC 2.1-2.7 $K^-p \rightarrow \Lambda\pi^+\pi^-$ neutrals¹ Supersedes AKHMETSHIN 97C. Γ_{14}/Γ NODE=M004R15
NODE=M004R15

NODE=M004R;LINKAGE=1N

 $\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

EVTS

DOCUMENT ID TECN COMMENT

0.41±0.12±0.04

30175

¹ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.3

90

² AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

<600

90

KALBFLEISCH 75 HBC 2.18 $K^-p \rightarrow$ $\Lambda\pi^+\pi^-\gamma$

< 70

90

COSME 74 OSPK $e^+e^- \rightarrow \pi^+\pi^-\gamma$

<400

90

LINDSEY 65 HBC 2.1-2.7 $K^-p \rightarrow$ $\Lambda\pi^+\pi^-$ neutrals¹ For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.² For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Γ_{15}/Γ NODE=M004R12
NODE=M004R12

NODE=M004R;LINKAGE=2N

NODE=M004R12;LINKAGE=Z3

 $\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

EVTS

DOCUMENT ID TECN COMMENT

3.22±0.19 OUR FIT Error includes scale factor of 1.1.**3.21±0.19 OUR AVERAGE**3.21^{+0.03}_{-0.09}±0.18¹ AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$

2.90±0.21±1.54

² AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma, \pi^0\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.47±0.21

2438

³ ALOISIO 02D KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$ 3.5 ±0.3 ^{+1.3}_{-0.5}

419

4,5 ACHASOV 00H SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.93±0.46±0.50

27188

⁶ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

3.05±0.25±0.72

268

⁷ AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.5 ±0.5

268

⁸ AKHMETSHIN 99C CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

3.42±0.30±0.36

164

⁴ ACHASOV 98I SND $e^+e^- \rightarrow 5\gamma$

< 1

90

⁹ AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

< 7

90

¹⁰ AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

< 20

90

DRUZHININ 87 ND $e^+e^- \rightarrow \pi^0\pi^0\gamma$ Γ_{16}/Γ NODE=M004R30
NODE=M004R30

OCCUR=3

OCCUR=2

OCCUR=2

- ¹ Obtained by the authors taking into account the $\pi^+\pi^-$ decay mode. Includes a component due to $\pi\pi$ production via the $f_0(500)$ meson. Supersedes ALOISIO 02D.
- ² From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.
- ³ From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution. Superseded by AMBROSINO 07.
- ⁴ Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $B(\phi \rightarrow K\bar{K}\gamma)$ and using $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.
- ⁵ Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.
- ⁶ For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.
- ⁷ Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).
- ⁸ A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- ⁹ For destructive interference with the Bremsstrahlung process
- ¹⁰ For constructive interference with the Bremsstrahlung process

NODE=M004R30;LINKAGE=MB

NODE=M004R;LINKAGE=SL

NODE=M004R;LINKAGE=KD

NODE=M004R;LINKAGE=AI

NODE=M004R;LINKAGE=U8

NODE=M004R;LINKAGE=3N

NODE=M004R;LINKAGE=SM

NODE=M004R;LINKAGE=ST

NODE=M004R30;LINKAGE=A

NODE=M004R30;LINKAGE=B

 $\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$ Γ_{16}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.47 ± 0.15 OUR FIT				Error includes scale factor of 1.1. $[(2.48 \pm 0.15) \times 10^{-2}$ OUR 2024 FIT Scale factor = 1.1]
2.6 ± 0.2 ^{+0.8}/_{-0.3}	419	¹ ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M004R44

NODE=M004R44

NEW

- ¹ Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $B(\phi \rightarrow K\bar{K}\gamma)$ and using $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.

NODE=M004R44;LINKAGE=AI

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.07 ± 0.06 OUR AVERAGE					
1.07 ^{+0.01} / _{-0.03} ^{+0.06} / _{-0.06}			¹ AMBROSINO 07	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.08 ± 0.17 ± 0.09		268	AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.09 ± 0.03 ± 0.05		2438	ALOISIO 02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.158 ± 0.093 ± 0.052		419	^{2,3} ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<10		90	DRUZHININ 87	ND	$e^+e^- \rightarrow 5\gamma$

NODE=M004R26

NODE=M004R26

- ¹ Supersedes ALOISIO 02D.

- ² Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.

- ³ Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.

NODE=M004R26;LINKAGE=MB

NODE=M004R26;LINKAGE=U8

NODE=M004R26;LINKAGE=V8

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\eta\gamma)$ Γ_{17}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.04 OUR FIT				
0.865 ± 0.070 ± 0.017	419	¹ ACHASOV 00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.90 ± 0.08 ± 0.07	164	ACHASOV 98I	SND	$e^+e^- \rightarrow 5\gamma$
¹ Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.				

NODE=M004R39

NODE=M004R39

NODE=M004R39;LINKAGE=V8

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{total}$ Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.5 ± 2.7 ± 1.6		6.8k	¹ AKHMETSHIN 17	CMD3	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.93 ± 1.74 ± 2.14		3.3k	AKHMETSHIN 00E	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
< 870		90	CORDIER 79	WIRE	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M004R22

NODE=M004R22

- ¹ Using the cross section at the ϕ meson peak $\sigma(\phi) = 4172 \pm 42$ nb, the nonresonant cross section $\sigma(0) = 1.263 \pm 0.027$ nb and $\text{Re}(Z) = 0.146 \pm 0.030$, $\text{Im}(Z) = -0.002 \pm 0.024$ for the complex amplitude of the $\phi \rightarrow \pi^+\pi^-\pi^+\pi^-$ transition.

NODE=M004R22;LINKAGE=A

 $\Gamma(\pi^+\pi^+\pi^-\pi^-)/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.6		90	AKHMETSHIN 00E	CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<150		95	BARKOV 88	CMD $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M004R27

NODE=M004R27

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$

Γ_{20}/Γ

VALUE (units 10^{-5}) CL% EVTS DOCUMENT ID TECN COMMENT

NODE=M004R31
NODE=M004R31

1.33^{+0.07}_{-0.10} OUR AVERAGE

1.35 ± 0.05 ^{+0.05} _{-0.10}	9.5k	1	ANASTASI	16B	KLOE	$e^+e^- \rightarrow \pi^0 e^+e^-$
1.01 ± 0.28 ± 0.29	52	2	ACHASOV	02D	SND	$e^+e^- \rightarrow \pi^0 e^+e^-$
1.22 ± 0.34 ± 0.21	46	3	AKHMETSHIN	01C	CMD2	$e^+e^- \rightarrow \pi^0 e^+e^-$

••• We do not use the following data for averages, fits, limits, etc. •••

<12	90		DOLINSKY	88	ND	$e^+e^- \rightarrow \pi^0 e^+e^-$
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- ¹ Using $B(\pi^0 \rightarrow \gamma\gamma)$ from the 2014 Edition of this Review (PDG 14).
- ² Using various branching ratios from the 2000 Edition of this Review (PDG 00).
- ³ Using $B(\pi^0 \rightarrow \gamma\gamma) = 0.98798 \pm 0.00032$, $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$, and $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.

NODE=M004R31;LINKAGE=A
NODE=M004R;LINKAGE=DS
NODE=M004R;LINKAGE=5H

$\Gamma(\pi^0 \eta\gamma)/\Gamma_{total}$

Γ_{21}/Γ

VALUE (units 10^{-5}) CL% EVTS DOCUMENT ID TECN COMMENT

NODE=M004R32
NODE=M004R32

7.27 ± 0.30 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

7.06 ± 0.22	16.9k	1	AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.51 ± 0.51 ± 0.57	607	2	ALOISIO	02C	KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
7.96 ± 0.60 ± 0.40	197	3	ALOISIO	02C	KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8 ± 1.4 ± 0.9	36	4	ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
9.0 ± 2.4 ± 1.0	80		AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

OCCUR=2

••• We do not use the following data for averages, fits, limits, etc. •••

7.01 ± 0.10 ± 0.20	13.3k	2,5	AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
7.12 ± 0.13 ± 0.22	3.6k	3,6	AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.3 ± 2.3 ± 1.2	20		ACHASOV	98B	SND	$e^+e^- \rightarrow 5\gamma$
<250	90		DOLINSKY	91	ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

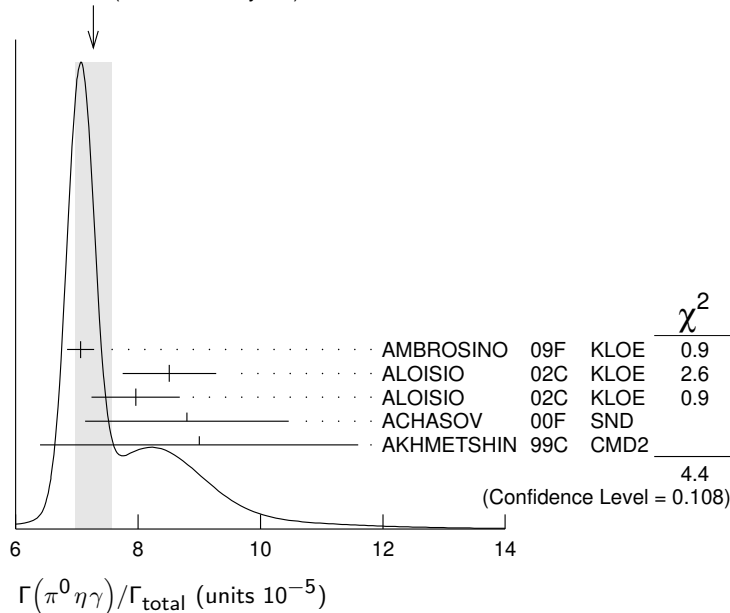
OCCUR=2
OCCUR=3

- ¹ Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decay modes measurements.
- ² From the decay mode $\eta \rightarrow \gamma\gamma$.
- ³ From the decay mode $\eta \rightarrow \pi^+\pi^-\pi^0$.
- ⁴ Supersedes ACHASOV 98B.
- ⁵ Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.
- ⁶ Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.

NODE=M004R32;LINKAGE=AM
NODE=M004R;LINKAGE=C1
NODE=M004R;LINKAGE=C2
NODE=M004R32;LINKAGE=AF
NODE=M004R32;LINKAGE=AB

NODE=M004R32;LINKAGE=AR

WEIGHTED AVERAGE
7.27 ± 0.30 (Error scaled by 1.5)



$\Gamma(a_0(980)\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ VALUE (units 10^{-5}) CL% EVTS

DOCUMENT ID TECN COMMENT

7.6±0.6 OUR FIT
7.6±0.6 OUR AVERAGE

7.4±0.7		1	ALOISIO	02C	KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36	2	ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
11 ±2		3	GOKALP	02	RVUE	$e^+e^- \rightarrow \eta\pi^0\gamma$
<500	90		DOLINSKY	91	ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

¹ Using $M_{a_0(980)}=984.8$ MeV and assuming $a_0(980)\gamma$ dominance.² Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.³ Using data of ACHASOV 00F.NODE=M004R33
NODE=M004R33NODE=M004R;LINKAGE=C3
NODE=M004R33;LINKAGE=AF
NODE=M004R;LINKAGE=GK $\Gamma(f_0(980)\gamma)/\Gamma(a_0(980)\gamma)$ Γ_{16}/Γ_{22}

VALUE

DOCUMENT ID TECN COMMENT

6.1±0.61 ALOISIO 02C KLOE $e^+e^- \rightarrow \eta\pi^0\gamma$ ¹ Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.NODE=M004R47
NODE=M004R47

NODE=M004R;LINKAGE=C4

 $\Gamma(K^0\bar{K}^0\gamma)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE CL%

DOCUMENT ID TECN COMMENT

<1.9 × 10⁻⁸90 AMBROSINO 09C KLOE $e^+e^- \rightarrow K_S^0 K_S^0\gamma$ NODE=M004R48
NODE=M004R48 $\Gamma(\eta'(958)\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ VALUE (units 10^{-5}) CL% EVTS

DOCUMENT ID TECN COMMENT

6.23±0.21 OUR FIT[(6.21 ± 0.20) × 10⁻⁵ OUR 2024 FIT]**6.24±0.30 OUR AVERAGE**[(6.21 ± 0.29) × 10⁻⁵ OUR 2024 AVERAGE]

6.23±0.27±0.12	3407	1	AMBROSINO	07A	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
6.7 ^{+2.8} _{-2.4} ±0.8	12	2	AULCHENKO	03B	SND	$e^+e^- \rightarrow \eta'\gamma$
6.7 ^{+5.0} _{-4.2} ±1.5	7		AULCHENKO	03B	SND	$e^+e^- \rightarrow 7\gamma$
6.10±0.61±0.43	120	3	ALOISIO	02E	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-3\gamma$
8.2 ^{+2.1} _{-1.9} ±1.1	21	4	AKHMETSHIN	00B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
4.9 ^{+2.2} _{-1.8} ±0.6	9	5	AKHMETSHIN	00F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ±1.6	30	6	AKHMETSHIN	00F	CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
6.7 ^{+3.4} _{-2.9} ±1.0	5	7	AULCHENKO	99	SND	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<11	90		AULCHENKO	98	SND	$e^+e^- \rightarrow 7\gamma$
12 ⁺⁷ ₋₅ ±2	6	4	AKHMETSHIN	97B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
<41	90		DRUZHININ	87	ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

¹ AMBROSINO 07A reports $[\Gamma(\phi(1020) \rightarrow \eta'(958)\gamma)/\Gamma_{\text{total}}] / [B(\phi(1020) \rightarrow \eta\gamma)] = (4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$ which we multiply by our best value $B(\phi(1020) \rightarrow \eta\gamma) = (1.306 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Averaging AULCHENKO 03B with AULCHENKO 99.³ Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.⁴ Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.⁵ Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.⁶ Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.⁷ Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.NODE=M004R25
NODE=M004R25

NEW

NEW

OCCUR=2

OCCUR=2

NODE=M004R25;LINKAGE=AM

NODE=M004R25;LINKAGE=BK
NODE=M004R;LINKAGE=E2
NODE=M004R25;LINKAGE=QNODE=M004R;LINKAGE=T2
NODE=M004R;LINKAGE=T3
NODE=M004R25;LINKAGE=AU $\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0 K_S^0)$ Γ_{24}/Γ_2 VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

1.85±0.06 OUR FIT[(1.83 ± 0.06) × 10⁻⁴ OUR 2024 FIT]

1.46 ^{+0.64} _{-0.54} ±0.18	9	1	AKHMETSHIN	00F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
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¹ Using various branching ratios of K_S^0 , K_L^0 , η , η' from the 2000 edition (The European Physical Journal **C15** 1 (2000)) of this Review.NODE=M004R43
NODE=M004R43

NEW

NODE=M004R;LINKAGE=T1

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{24}/Γ_5 VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

4.77±0.15 OUR FIT**4.78±0.20 OUR AVERAGE**

4.77±0.09±0.19 3407

AMBROSINO 07A KLOE 1.02 $e^+e^- \rightarrow \pi^+\pi^-7\gamma$

4.70±0.47±0.31 120

¹ ALOISIO 02E KLOE 1.02 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$ 6.5 $^{+1.7}_{-1.5}$ ±0.8 21AKHMETSHIN 00B CMD2 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.5 $^{+5.2}_{-4.0}$ ±1.4 6² AKHMETSHIN 97B CMD2 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$ ¹ From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.² Superseded by AKHMETSHIN 00B.NODE=M004R34
NODE=M004R34NODE=M004R;LINKAGE=E1
NODE=M004R;LINKAGE=KS $\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<2

90

AULCHENKO 98

SND

 $e^+e^- \rightarrow 7\gamma$ NODE=M004R36
NODE=M004R36 $\Gamma(\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

1.43±0.45±0.14

27188

¹ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \mu^+\mu^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ±1.0 824 ± 33

² AKHMETSHIN 97C CMD2 $e^+e^- \rightarrow \mu^+\mu^-\gamma$ ¹ For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.² For $E_\gamma > 20$ MeV.NODE=M004R35
NODE=M004R35NODE=M004R35;LINKAGE=3N
NODE=M004R35;LINKAGE=A $\Gamma(\rho\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<1.2

90

AULCHENKO 08

CMD2

 $\phi \rightarrow \pi^+\pi^-\gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5

90

AKHMETSHIN 98

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$ NODE=M004R37
NODE=M004R37 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

< 1.8

90

AKHMETSHIN 00E

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6.1

90

AULCHENKO 08

CMD2

 $\phi \rightarrow \eta\pi^+\pi^-$

<30

90

AKHMETSHIN 98

CMD2

 $e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$ NODE=M004R38
NODE=M004R38 $\Gamma(\eta\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

<9.4

90

AKHMETSHIN 01

CMD2

 $e^+e^- \rightarrow \eta e^+e^-$ NODE=M004R45
NODE=M004R45 $\Gamma(\eta U \rightarrow \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<1 × 10⁻⁶

90

¹ BABUSCI 13B

KLOE

1.02 $e^+e^- \rightarrow \eta e^+e^-$ ¹ For a narrow vector U with mass between 5 and 470 MeV, from the combined analysis of $\eta \rightarrow \pi^+\pi^-\pi^0$ and $\eta \rightarrow \pi^0\pi^0\pi^0$ from ARCHILLI 12. Measured 90% CL limits as a function of m_U range from 2.2×10^{-8} to 10^{-6} .NODE=M004R01
NODE=M004R01

NODE=M004R01;LINKAGE=A

 $\Gamma(\text{invisible})/\Gamma(K^+K^-)$ Γ_{31}/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<3.4 × 10⁻⁴

90

ABLIKIM 18S

BES3

 $J/\psi \rightarrow \phi\eta \rightarrow \phi\pi^+\pi^-\pi^0$ NODE=M004R02
NODE=M004R02

————— Lepton Family number (LF) violating modes —————

NODE=M00422A

 $\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<2 × 10⁻⁶

90

ACHASOV 10A

SND

 $e^+e^- \rightarrow e^\pm\mu^\mp$ NODE=M004R29
NODE=M004R29 $\pi^+\pi^-\pi^0 / \rho\pi$ AMPLITUDE RATIO a_1 IN DECAY OF $\phi \rightarrow \pi^+\pi^-\pi^0$

NODE=M004D1

NIECKNIG 12 describes final-state interactions between the three pions in a dispersive framework using data on the $\pi\pi$ P -wave scattering phase shift.

NODE=M004D1

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.2 OUR AVERAGE					
10.1±4.4±1.7		80k	¹ AKHMETSHIN 06	CMD2	1.017–1.021 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0±1.1±0.6		1.98M	^{2,3} ALOISIO	03 KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$-6 < a_1 < 6$		500k	³ ACHASOV 02	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$-16 < a_1 < 11$	90	9.8k	^{1,4} AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$
¹ Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.					
² From a fit without limitations on charged and neutral ρ masses and widths.					
³ Recalculated by us to match the notations of AKHMETSHIN 98.					
⁴ Assuming zero phase for the contact term.					

NODE=M004D1

NODE=M004D1;LINKAGE=AK

NODE=M004D;LINKAGE=L1

NODE=M004D;LINKAGE=L3

NODE=M004D1;LINKAGE=KL

PARAMETER β IN $\phi \rightarrow P e^+ e^-$ DECAYS

In the one-pole approximation the electromagnetic transition form factor for $\phi \rightarrow P e^+ e^-$ ($P = \pi, \eta$) is given as a function of the $e^+ e^-$ invariant mass squared, q^2 , by the expression:

$$|F(q^2)|^2 = (1 - q^2/\Lambda^2)^{-2},$$

where vector meson dominance predicts parameter $\Lambda \approx 0.770$ GeV ($\Lambda^{-2} \approx 1.687$ GeV $^{-2}$). The slope of this form factor, $\beta = dF/dq^2(q^2=0)$, equals Λ^{-2} in this approximation.

The measurements below obtain β in the one-pole approximation.

NODE=M004230

NODE=M004230

PARAMETER β IN $\phi \rightarrow \pi^0 e^+ e^-$ DECAY

VALUE (GeV $^{-2}$)	EVTS	DOCUMENT ID	TECN	COMMENT
2.02±0.11	9.5k	¹ ANASTASI 16B	KLOE	1.02 $e^+e^- \rightarrow \pi^0 e^+e^-$

¹ The error combines statistical and systematic uncertainties.

NODE=M004A00
NODE=M004A00

NODE=M004A00;LINKAGE=A

PARAMETER β IN $\phi \rightarrow \eta e^+ e^-$ DECAY

VALUE (GeV $^{-2}$)	EVTS	DOCUMENT ID	TECN	COMMENT
1.29±0.13 OUR AVERAGE				
1.28±0.10 ^{+0.09} _{-0.08}	30k	BABUSCI 15	KLOE	1.02 $e^+e^- \rightarrow \eta e^+e^-$
3.8 ±1.8	213	¹ ACHASOV 01B	SND	1.02 $e^+e^- \rightarrow \eta e^+e^-$

¹ The uncertainty is statistical only. The systematic one is negligible, in comparison.

NODE=M004BFP
NODE=M004BFP

NODE=M004BFP;LINKAGE=A

$\phi(1020)$ REFERENCES

ABLIKIM 25A	PRL 134 011904	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63174
AAIJ 24B	JHEP 2405 293	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62690
ACHASOV 24	PR D110 072001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=63024
DUBNICKA 24	PR D110 054019	S. Dubnicka <i>et al.</i>	(SLOV, CMNS)	REFID=63023
IGNATOV 24	PR D109 112002	F.V. Ignatov <i>et al.</i>	(CMD-3 Collab.)	REFID=62672
PDG 22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
LEES 21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
HOID 20	EPJ C80 988	B.-L. Hoid, M. Hoferichter, B. Kubis	(BONN, BERN)	REFID=61048
AAIJ 19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59670
HOFFERICH... 19	JHEP 1908 137	M. Hoferichter, B.-L. Hoid, B. Kubis	(WASH, BONN)	REFID=60974
ABLIKIM 18S	PR D98 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58971
AOUDE 18	PR D98 056021	R.T. Aoude <i>et al.</i>		REFID=59987
KOZYREV 18	PL B779 64	E.A. Kozyrev <i>et al.</i>	(CMD-3 Collab.)	REFID=58794
AKHMETSHIN 17	PL B768 345	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	REFID=57893
ACHASOV 16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57513
ANASTASI 16B	PL B757 362	A. Anastasi <i>et al.</i>	(KLOE-2 Collab.)	REFID=57399
KOZYREV 16	PL B760 314	E.A. Kozyrev <i>et al.</i>	(CMD-3 Collab.)	REFID=57514
BABUSCI 15	PL B742 1	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)	REFID=56374
PDG 15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977; ERROR=7
LEES 14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
PDG 14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
BABUSCI 13B	PL B720 111	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)	REFID=55068
BENAYOUN 13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono	(PARIN, BERLIN+)	REFID=55357
LEES 13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55127
LEES 13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
ARCHILLI 12	PL B706 251	F. Archilli <i>et al.</i>	(KLOE-2 Collab.)	REFID=53951
BENAYOUN 12	EPJ C72 1848	M. Benayoun <i>et al.</i>		REFID=54281
NIECKNIG 12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)	REFID=54305
PDG 12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
AKHMETSHIN 11	PL B695 412	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=53645

NODE=M004

ACHASOV	10A	PR D81 057102	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=53352
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
AMBROSINO	09C	PL B679 10	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52969
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=53105
AKHMETSHIN	08	PL B669 217	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=52572
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52573
AULCHENKO	08	JETPL 88 85	V. Aulchenko <i>et al.</i>	(CMD-2 Collab.)	REFID=52268
		Translated from ZETFP 88 93.			
FLOREZ-BAEZ	08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro		REFID=52584
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51646
DUBYSKIY	07	PR D75 113001	S. Dubynskiy <i>et al.</i>		REFID=51719
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=51465
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AMBROSINO	05	PL B608 199	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=50453
AUBERT,B	05J	PR D72 052008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50824
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
AULCHENKO	03B	JETP 97 24	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49613
		Translated from ZETF 124 28.			
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02D	JETPL 75 449	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48814
		Translated from ZETFP 75 539.			
ALOISIO	02C	PL B536 209	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48823
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ALOISIO	02E	PL B541 45	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48825
FISCHBACH	02	PL B526 355	E. Fischbach, A.W. Overhauser, B. Woodahl		REFID=48575
GOKALP	02	JP G28 2783	A. Gokalp <i>et al.</i>		REFID=49167
ACHASOV	01B	PL B504 275	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48111
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
ACHASOV	01G	PRL 86 1698	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48315
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48110
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
AKHMETSHIN	01C	PL B503 237	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48323
BENAYOUN	01	EPJ C22 503	M. Benayoun, H.B. O'Connell		REFID=48570
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00B	JETP 90 17	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47425
		Translated from ZETF 117 22.			
ACHASOV	00C	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47422
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47936
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47937
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
BRAMON	00	PL B486 406	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ACHASOV	99	PL B449 122	M.N. Achasov <i>et al.</i>		REFID=46896
ACHASOV	99C	PL B456 304	M.N. Achasov <i>et al.</i>		REFID=46939
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin <i>et al.</i>		REFID=47397
		Also			
AKHMETSHIN	99F	PL B508 217 (errat.)	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48328
ACHASOV	99	PL B460 242	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47473
AULCHENKO	99	JETPL 69 97	V.M. Aulchenko <i>et al.</i>		REFID=46920
		Translated from ZETFP 69 87.			
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=46325
AULCHENKO	98	PL B436 199	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46336
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46344
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin <i>et al.</i>	(NOVO, BOST, PITT+)	REFID=45801
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=45802
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=44617
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BARKOV	88	SJNP 47 248	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=41024
		Translated from YAF 47 393.			
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
		Translated from YAF 48 442.			
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=40448
ARMSTRONG	86	PL 166B 245	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20563
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
BEBEK	86	PRL 56 1893	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=11540
DAVENPORT	86	PR D33 2519	T.F. Davenport (TUFTS, ARIZ, FNAL, FSU, NDAM+)		REFID=20567
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra <i>et al.</i>	(ANIK, BRIS, CERN+)	REFID=20568
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)	REFID=20569
GOLUBEV	86	SJNP 44 409	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40449
		Translated from YAF 44 633.			
ALBRECHT	85D	PL 153B 343	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=20562
GOLUBEV	85	SJNP 41 756	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40450
		Translated from YAF 41 1183.			
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BARATE	83	PL 121B 449	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, IND)	REFID=12177
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20560
		Translated from ZETFP 38 306.			

ARENTON	82	PR D25 2241	M.W. Arenton <i>et al.</i>	(ANL, ILL)	REFID=20556
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HEL5)	REFID=20557
DAUM	81	PL 100B 439	C. Daum <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)	REFID=20552
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
Also		Private Comm.	S.I. Eidelman	(NOVO)	REFID=20554
VASSERMAN	81	PL 99B 62	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=20555
Also		SJNP 35 240	L.M. Kurdadze <i>et al.</i>		REFID=47475
		Translated from YAF 35 352			
CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
CORDIER	79	PL 81B 389	A. Cordier <i>et al.</i>	(LALO)	REFID=20549
BUKIN	78B	SJNP 27 521	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20545
		Translated from YAF 27 985			
BUKIN	78C	SJNP 27 516	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20544
		Translated from YAF 27 976			
COOPER	78B	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
LOSTY	78	NP B133 38	M.J. Losty <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=20547
AKERLOF	77	PRL 39 861	C.W. Akerlof <i>et al.</i>	(FNAL, MICH, PURD)	REFID=20534
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
BALDI	77	PL 68B 381	R. Baldi <i>et al.</i>	(GEVA)	REFID=20536
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+)	REFID=20537
COHEN	77	PRL 38 269	D. Cohen <i>et al.</i>	(ANL)	REFID=20538
LAVEN	77	NP B127 43	H. Laven <i>et al.</i>	(AACH3, BERL, CERN, LOIC+)	REFID=20541
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)	REFID=20232
COSME	76	PL 63B 352	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20529
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20531
PARROUR	76	PL 63B 357	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20532
PARROUR	76B	PL 63B 362	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20533
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AYRES	74	PRL 32 1463	D.S. Ayres <i>et al.</i>	(ANL)	REFID=20522
BESCH	74	NP B70 257	H.J. Besch <i>et al.</i>	(BONN)	REFID=20523
COSME	74	PL 48B 155	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20525
COSME	74B	PL 48B 159	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20526
DEGROOT	74	NP B74 77	A.J. de Groot <i>et al.</i>	(AMST, NIJM)	REFID=20527
AUGUSTIN	73	PRL 30 462	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=47515
BALLAM	73	PR D7 3150	J. Ballam <i>et al.</i>	(SLAC, LBL)	REFID=20520
BINNIE	73B	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
ALVENSLEB...	72	PRL 28 66	H. Alvensleben <i>et al.</i>	(MIT, DESY)	REFID=20514
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
COLLEY	72	NP B50 1	D.C. Colley <i>et al.</i>	(BIRM, GLAS)	REFID=20519
BALAKIN	71	PL 34B 328	V.E. Balakin <i>et al.</i>	(NOVO)	REFID=20507
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)	REFID=20508
Also		PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
HAYES	71	PR D4 899	S. Hayes <i>et al.</i>	(CORN)	REFID=20511
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)	REFID=20512
BIZOT	70	PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba		REFID=20502
EARLES	70	PRL 25 1312	D.R. Earles <i>et al.</i>	(NEAS)	REFID=20504
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)	REFID=20481
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IGJPC	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)	REFID=20478
LINDSEY	65	data included in LINDSEY 66.			
SCHLEIN	63	PRL 10 368	P.E. Schlein <i>et al.</i>	(UCLA) IGJP	REFID=20474

$h_1(1170)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

NODE=M030

 $h_1(1170)$ MASS

NODE=M030M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1166 ± 5 ± 3	¹ ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1168 ± 4	ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1190 ± 60	² DANKOWY...	81	SPEC 0	8 $\pi p \rightarrow 3\pi n$

NODE=M030M
OCCUR=2

- ¹ Average and spread of values using 2 variants of the model of BOWLER 75.
² Uses the model of BOWLER 75.

NODE=M030M;LINKAGE=B
NODE=M030M;LINKAGE=C **$h_1(1170)$ WIDTH**

NODE=M030W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
375 ± 6 ± 34	³ ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
345 ± 6	ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
320 ± 50	⁴ DANKOWY...	81	SPEC 0	8 $\pi p \rightarrow 3\pi n$

NODE=M030W
OCCUR=2

- ³ Average and spread of values using 2 variants of the model of BOWLER 75.
⁴ Uses the model of BOWLER 75.

NODE=M030W;LINKAGE=B
NODE=M030W;LINKAGE=C **$h_1(1170)$ DECAY MODES**

NODE=M030215;NODE=M030

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

 $h_1(1170)$ BRANCHING RATIOS

NODE=M030220

$\Gamma(\rho\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	ANDO	92	SPEC	8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
seen	ATKINSON	84	OMEG	20-70 $\gamma p \rightarrow \pi^+ \pi^- \pi^0 p$
seen	DANKOWY...	81	SPEC	8 $\pi p \rightarrow 3\pi n$

NODE=M030R1
NODE=M030R1 **$h_1(1170)$ REFERENCES**

NODE=M030

ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ATKINSON	84	NP B231 15	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
DANKOWY...	81	PRL 46 580	J.A. Dankowych <i>et al.</i>	(TNTO, BNL, CARL+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

REFID=43171
REFID=20574
REFID=20572
REFID=20571

$b_1(1235)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

NODE=M011

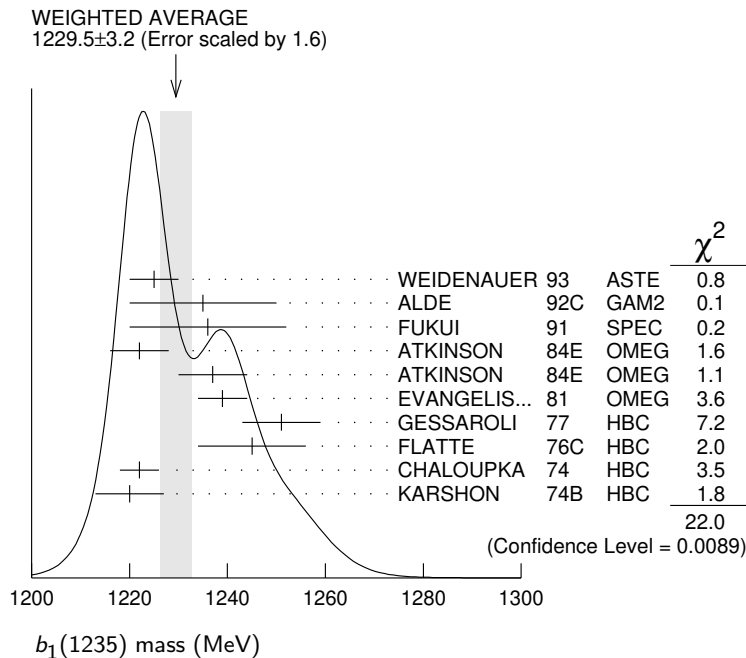
 $b_1(1235)$ MASS

NODE=M011M

NODE=M011M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1229.5 ± 3.2 OUR AVERAGE		Error includes scale factor of 1.6.			See the ideogram below.
1225 ± 5		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
1235 ± 15		ALDE 92C	GAM2		38,100 $\pi^- p \rightarrow \omega \pi^0 n$
1236 ± 16		FUKUI 91	SPEC		8.95 $\pi^- p \rightarrow \omega \pi^0 n$
1222 ± 6		ATKINSON 84E	OMEG ±		25-55 $\gamma p \rightarrow \omega \pi X$
1237 ± 7		ATKINSON 84E	OMEG 0		25-55 $\gamma p \rightarrow \omega \pi X$
1239 ± 5		EVANGELIS...	81 OMEG -		12 $\pi^- p \rightarrow \omega \pi p$
1251 ± 8	450	GESSAROLI 77	HBC -		11 $\pi^- p \rightarrow \pi^- \omega p$
1245 ± 11	890	FLATTE 76C	HBC -		4.2 $K^- p \rightarrow \pi^- \omega \Sigma^+$
1222 ± 4	1400	CHALOUPKA 74	HBC -		3.9 $\pi^- p$
1220 ± 7	600	KARSHON 74B	HBC +		4.9 $\pi^+ p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1190 ± 10		AUGUSTIN 89	DM2 ±		$e^+ e^- \rightarrow 5\pi$
1213 ± 5		ATKINSON 84C	OMEG 0		20-70 γp
1271 ± 11		COLLICK 84	SPEC +		200 $\pi^+ Z \rightarrow Z \pi \omega$

OCCUR=2

 **$b_1(1235)$ WIDTH**

NODE=M011W

NODE=M011W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
142 ± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
113 ± 12		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
160 ± 30		ALDE 92C	GAM2		38,100 $\pi^- p \rightarrow \omega \pi^0 n$
151 ± 31		FUKUI 91	SPEC		8.95 $\pi^- p \rightarrow \omega \pi^0 n$
170 ± 15		EVANGELIS...	81 OMEG -		12 $\pi^- p \rightarrow \omega \pi p$
170 ± 50	225	BALTAY 78B	HBC +		15 $\pi^+ p \rightarrow p 4\pi$
155 ± 32	450	GESSAROLI 77	HBC -		11 $\pi^- p \rightarrow \pi^- \omega p$
182 ± 45	890	FLATTE 76C	HBC -		4.2 $K^- p \rightarrow \pi^- \omega \Sigma^+$
135 ± 20	1400	CHALOUPKA 74	HBC -		3.9 $\pi^- p$
156 ± 22	600	KARSHON 74B	HBC +		4.9 $\pi^+ p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
210 ± 19		AUGUSTIN 89	DM2 ±		$e^+ e^- \rightarrow 5\pi$
231 ± 14		ATKINSON 84C	OMEG 0		20-70 γp
232 ± 29		COLLICK 84	SPEC +		200 $\pi^+ Z \rightarrow Z \pi \omega$

$b_1(1235)$ DECAY MODES

NODE=M011215;NODE=M011

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\omega\pi$ [D/S amplitude ratio = 0.277 ± 0.027]	seen	
Γ_2 $\pi^\pm\gamma$	$(1.6 \pm 0.4) \times 10^{-3}$	
Γ_3 $\eta\rho$	seen	
Γ_4 $\pi^+\pi^+\pi^-\pi^0$	< 50 %	84%
Γ_5 $K^*(892)^\pm K^\mp$	seen	
Γ_6 $(K\bar{K})^\pm\pi^0$	< 8 %	90%
Γ_7 $K_S^0 K_L^0 \pi^\pm$	< 6 %	90%
Γ_8 $K_S^0 K_S^0 \pi^\pm$	< 2 %	90%
Γ_9 $\phi\pi$	< 1.5 %	84%

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=9
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=74
DESIG=71;OUR EST;→ UNCHECKED ←
DESIG=73;OUR EST;→ UNCHECKED ←
DESIG=72;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←

$b_1(1235)$ PARTIAL WIDTHS

NODE=M011220

$\Gamma(\pi^\pm\gamma)$	VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2
	230±60	COLLICK	84	SPEC	+	200 $\pi^+ Z \rightarrow Z\pi\omega$

NODE=M011W3
NODE=M011W3

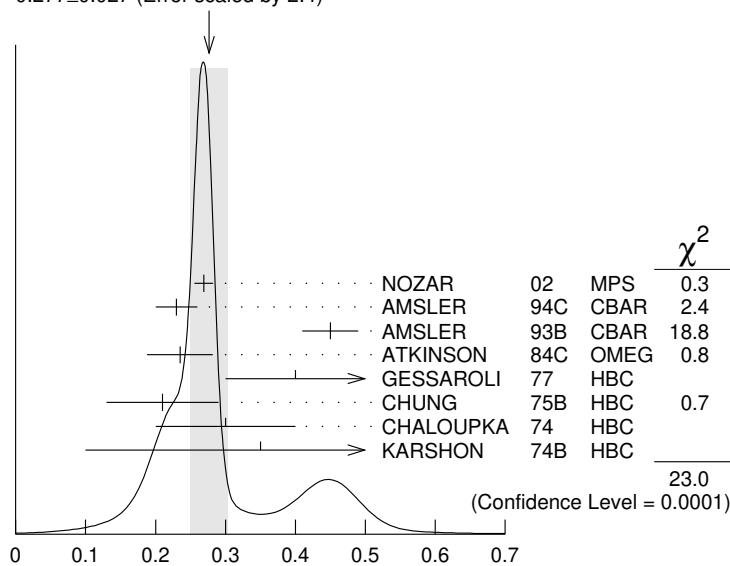
$b_1(1235)$ D-wave/S-wave AMPLITUDE RATIO IN DECAY OF $b_1(1235) \rightarrow \omega\pi$

NODE=M011DS

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.277±0.027 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.			
0.269±0.009±0.010		NOZAR	02	MPS	- 18 $\pi^- p \rightarrow \omega\pi^- p$
0.23 ±0.03		AMSLER	94C	CBAR	0.0 $\bar{p}p \rightarrow \omega\eta\pi^0$
0.45 ±0.04		AMSLER	93B	CBAR	0.0 $\bar{p}p \rightarrow \omega\pi^0\pi^0$
0.235±0.047		ATKINSON	84C	OMEG	20-70 γp
0.4 $\begin{smallmatrix} +0.1 \\ -0.1 \end{smallmatrix}$		GESSAROLI	77	HBC	- 11 $\pi^- p \rightarrow \pi^- \omega p$
0.21 ±0.08		CHUNG	75B	HBC	+ 7.1 $\pi^+ p$
0.3 ±0.1		CHALOUPKA	74	HBC	- 3.9-7.5 $\pi^- p$
0.35 ±0.25	600	KARSHON	74B	HBC	+ 4.9 $\pi^+ p$

NODE=M011DS

WEIGHTED AVERAGE
0.277±0.027 (Error scaled by 2.4)



$b_1(1235)$ D-wave/S-wave amplitude ratio in decay of $b_1(1235) \rightarrow \omega\pi$

$b_1(1235)$ D-wave/S-wave AMPLITUDE PHASE DIFFERENCE IN DECAY OF $b_1(1235) \rightarrow \omega\pi$

NODE=M011PH

VALUE (°)	DOCUMENT ID	TECN	CHG	COMMENT
10.5±2.4±3.9	NOZAR	02	MPS	- 18 $\pi^- p \rightarrow \omega\pi^- p$

NODE=M011PH

$b_1(1235)$ BRANCHING RATIOS

NODE=M011230

 $\Gamma(\eta\rho)/\Gamma(\omega\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	ATKINSON	84D	OMEG	20-70 γp

NODE=M011R9
NODE=M011R9 $\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma(\omega\pi)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.5	ABOLINS	63	HBC	+ 3.5 $\pi^+ p$

NODE=M011R1
NODE=M011R1 $\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	¹ ABLIKIM	10E	BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M011R10
NODE=M011R10¹ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M011R10;LINKAGE=AB

 $\Gamma((K\bar{K})^\pm \pi^0)/\Gamma(\omega\pi)$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.08	90	BALTAY	67	HBC	\pm 0.0 $\bar{p} p$

NODE=M011R6
NODE=M011R6 $\Gamma(K_S^0 K_L^0 \pi^\pm)/\Gamma(\omega\pi)$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.06	90	BALTAY	67	HBC	\pm 0.0 $\bar{p} p$

NODE=M011R8
NODE=M011R8 $\Gamma(K_S^0 K_S^0 \pi^\pm)/\Gamma(\omega\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.02	90	BALTAY	67	HBC	\pm 0.0 $\bar{p} p$

NODE=M011R7
NODE=M011R7 $\Gamma(\phi\pi)/\Gamma(\omega\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.004	95	VIKTOROV	96	SPEC	0 32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$

NODE=M011R4
NODE=M011R4

••• We do not use the following data for averages, fits, limits, etc. •••

<0.04	95	BIZZARRI	69	HBC	\pm 0.0 $\bar{p} p$
<0.015		DAHL	67	HBC	1.6-4.2 $\pi^- p$

 $b_1(1235)$ REFERENCES

NODE=M011

ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
NOZAR	02	PL B541 35	M. Nozar <i>et al.</i>		REFID=48850
VIKTOROV	96	PAN 59 1184	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=45203
		Translated from YAF 59 1239.			
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ATKINSON	84C	NP B243 1	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+) JP	REFID=20625
ATKINSON	84D	NP B242 269	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20623
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20624
COLLICK	84	PRL 53 2374	B. Collick <i>et al.</i>	(MINN, ROCH, FNAL)	REFID=20626
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+) JP	REFID=20230
FLATTE	76C	PL 64B 225	S.M. Flatte <i>et al.</i>	(CERN, AMST, NIJM+) JP	REFID=20615
CHUNG	75B	PR D11 2426	S.U. Chung <i>et al.</i>	(BNL, LBL, UCSC) JP	REFID=20613
CHALOUPKA	74	PL 51B 407	V. Chaloupka <i>et al.</i>	(CERN) JP	REFID=20611
KARSHON	74B	PR D10 3608	U. Karshon <i>et al.</i>	(REHO) JP	REFID=20612
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
BALTAY	67	PRL 18 93	C. Baltay <i>et al.</i>	(COLU)	REFID=20159
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL)	REFID=20321
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006

$a_1(1260)$

$$I^G(J^{PC}) = 1^-(1^{++})$$

See also our review under the $a_1(1260)$ in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M010

NODE=M010

$a_1(1260)$ T-MATRIX POLE \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M010PP

NODE=M010PP

NODE=M010PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$(1209^{+13}_{-10}) - i(288^{+45}_{-12})$	OUR ESTIMATE		
$(1209 \pm 4^{+12}_{-9}) - i(288 \pm 6^{+45}_{-10})$	MIKHASENKO 18	RVUE	$\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau$

$a_1(1260)$ MASS

NODE=M010M

NODE=M010M

→ UNCHECKED ←

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1230 ± 40		OUR ESTIMATE		
1299 $\begin{smallmatrix} +12 \\ -28 \end{smallmatrix}$	46M	1 AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1195.05 ± 1.05 ± 6.33	894k	AAIJ	18A1	LHCB $D^0 \rightarrow K \bar{\pi} \pi^\pm \pi^\pm \pi^\mp$
1225 ± 9 ± 20	7k	2 DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1255 ± 6 $\begin{smallmatrix} +7 \\ -17 \end{smallmatrix}$	420k	3 ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1243 ± 12 ± 20		4 AUBERT	07AU	BABR $10.6 e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
1230–1270	6360	5 LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1203 ± 3		6 GOMEZ-DUM..04	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
1330 ± 24	90k	SALVINI	04	OBLX $\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
1331 ± 10 ± 3	37k	7 ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
1255 ± 7 ± 6	5904	8 ABREU	98G	DLPH $e^+ e^-$
1207 ± 5 ± 8	5904	9 ABREU	98G	DLPH $e^+ e^-$
1196 ± 4 ± 5	5904	10,11 ABREU	98G	DLPH $e^+ e^-$
1240 ± 10		BARBERIS	98B	450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1262 ± 9 ± 7		8,12 ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1210 ± 7 ± 2		9,12 ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1211 ± 7 $\begin{smallmatrix} +50 \\ -0 \end{smallmatrix}$		9 ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1121 ± 8		13 ANDO	92	SPEC $8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1242 ± 37		14 IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 14		15 IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1250 ± 9		16 IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1208 ± 15		ARMSTRONG	90	OMEG $300.0 pp \rightarrow pp \pi^+ \pi^- \pi^0$
1220 ± 15		17 ISGUR	89	RVUE $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 25		18 BOWLER	88	RVUE
1166 ± 18 ± 11		BAND	87	MAC $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1164 ± 41 ± 23		BAND	87	MAC $\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
1250 ± 40		17 TORNQVIST	87	RVUE
1046 ± 11		ALBRECHT	86B	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1056 ± 20 ± 15		RUCKSTUHL	86	DLCO $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1194 ± 14 ± 10		SCHMIDKE	86	MRK2 $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1255 ± 23		BELLINI	85	SPEC $40 \pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1240 ± 80		19 DANKOWY...	81	SPEC $8.45 \pi^- p \rightarrow n 3\pi$
1280 ± 30		19 DAUM	81B	CNTR $63,94 \pi^- p \rightarrow p 3\pi$
1041 ± 13		20 GAVILLET	77	HBC $4.2 K^- p \rightarrow \Sigma 3\pi$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

- 1 Statistical error negligible.
- 2 Reanalysis of CLEO data using Breit-Wigner parameterization.
- 3 Superseded by AGHASYAN 2018B.
- 4 The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.
- 5 Using the Breit-Wigner parameterization; strong correlation between mass and width.
- 6 Using the data of BARATE 98R.
- 7 From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
- 8 Uses the model of KUHN 90.
- 9 Uses the model of ISGUR 89.
- 10 Includes the effect of a possible a_1' state.
- 11 Uses the model of FEINDT 90.
- 12 Supersedes AKERS 95P.
- 13 Average and spread of values using 2 variants of the model of BOWLER 75.
- 14 Reanalysis of RUCKSTUHL 86.
- 15 Reanalysis of SCHMIDKE 86.
- 16 Reanalysis of ALBRECHT 86B.
- 17 From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
- 18 From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
- 19 Uses the model of BOWLER 75.
- 20 Produced in K^- backward scattering.

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$a_1(1260)$ WIDTH

NODE=M010W
 NODE=M010W
 → UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
380 ± 80	46M	¹ AGHASYAN	18B COMP	$190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
422.01 ± 2.10 ± 12.72	894k	AAIJ	18AI LHCB	$D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
430 ± 24 ± 31		² DARGENT	17 RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
367 ± 9 + ²⁸ / ₋₂₅	420k	³ ALEKSEEV	10 COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
410 ± 31 ± 30		⁴ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
520–680	6360	⁵ LINK	07A FOCS	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
480 ± 20		⁶ GOMEZ-DUM...	04 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
580 ± 41	90k	SALVINI	04 OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
460 ± 85	205	⁷ DRUTSKOY	02 BELL	$B \rightarrow D(*) K^- K^* 0$
814 ± 36 ± 13	37k	⁸ ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
450 ± 50	22k	⁹ AKHMETSHIN	99E CMD2	$1.05-1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
570 ± 10		¹⁰ BONDAR	99 RVUE	$e^+ e^- \rightarrow 4\pi, \tau \rightarrow 3\pi \nu_\tau$
587 ± 27 ± 21	5904	¹¹ ABREU	98G DLPH	$e^+ e^-$
478 ± 3 ± 15	5904	¹² ABREU	98G DLPH	$e^+ e^-$
425 ± 14 ± 8	5904	^{13,14} ABREU	98G DLPH	$e^+ e^-$
400 ± 35		BARBERIS	98B	$450 pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
621 ± 32 ± 58		^{11,15} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
457 ± 15 ± 17		^{12,15} ACKERSTAFF	97R OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
446 ± 21 + ¹⁴⁰ / ₋₀		¹² ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
239 ± 11		ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
266 ± 13 ± 4		¹⁶ ANDO	92 SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
465 + ²²⁸ / ₋₁₄₃		¹⁷ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
298 + ⁴⁰ / ₋₃₄		¹⁸ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
488 ± 32		¹⁹ IVANOV	91 RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
430 ± 50		ARMSTRONG	90 OMEG	$300.0 pp \rightarrow pp \pi^+ \pi^- \pi^0$
420 ± 40		²⁰ ISGUR	89 RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
396 ± 43		²¹ BOWLER	88 RVUE	
405 ± 75 ± 25		BAND	87 MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

OCCUR=2
 OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

419 ±108 ± 57	BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
521 ± 27	ALBRECHT	86B	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
476 ⁺¹³² ₋₁₂₀ ± 54	RUCKSTUHL	86	DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
462 ± 56 ± 30	SCHMIDKE	86	MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
292 ± 40	BELLINI	85	SPEC	$40 \pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
380 ±100	22 DANKOWY...	81	SPEC	$8.45 \pi^- \rho \rightarrow n3\pi$
300 ± 50	22 DAUM	81B	CNTR	$63,94 \pi^- \rho \rightarrow \rho3\pi$
230 ± 50	23 GAVILLET	77	HBC	$4.2 K^- \rho \rightarrow \Sigma3\pi$

OCCUR=2

- ¹ Statistical error negligible.
- ² Reanalysis of CLEO data using Breit-Wigner parameterization.
- ³ Superseded by AGHASYAN 2018B.
- ⁴ The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.
- ⁵ Using the Breit-Wigner parameterization; strong correlation between mass and width.
- ⁶ Using the data of BARATE 98R.
- ⁷ From a fit of the $K^- K^{*0}$ distribution assuming $m_{a_1} = 1230$ MeV and purely resonant production of the $K^- K^{*0}$ system.
- ⁸ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
- ⁹ Using the $a_1(1260)$ mass of 1230 MeV.
- ¹⁰ From AKHMETSIN 99E and ASNER 00 data using the $a_1(1260)$ mass of 1230 MeV.
- ¹¹ Uses the model of KUHN 90.
- ¹² Uses the model of ISGUR 89.
- ¹³ Includes the effect of a possible a_1' state.
- ¹⁴ Uses the model of FEINDT 90.
- ¹⁵ Supersedes AKERS 95P.
- ¹⁶ Average and spread of values using 2 variants of the model of BOWLER 75.
- ¹⁷ Reanalysis of RUCKSTUHL 86.
- ¹⁸ Reanalysis of SCHMIDKE 86.
- ¹⁹ Reanalysis of ALBRECHT 86B.
- ²⁰ From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.
- ²¹ From a combined reanalysis of ALBRECHT 86B and DAUM 81B.
- ²² Uses the model of BOWLER 75.
- ²³ Produced in K^- backward scattering.

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 NODE=M010W;LINKAGE=K
 NODE=M010W;LINKAGE=G
 NODE=M010W;LINKAGE=D
 NODE=M010W;LINKAGE=F

$a_1(1260)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 3π	seen
Γ_2 $(\rho\pi)S$ -wave, $\rho \rightarrow \pi\pi$	seen
Γ_3 $(\rho\pi)D$ -wave, $\rho \rightarrow \pi\pi$	seen
Γ_4 $(\rho(1450)\pi)S$ -wave, $\rho \rightarrow \pi\pi$	seen
Γ_5 $(\rho(1450)\pi)D$ -wave, $\rho \rightarrow \pi\pi$	seen
Γ_6 $f_0(500)\pi$, $f_0 \rightarrow \pi\pi$	seen
Γ_7 $f_0(980)\pi$, $f_0 \rightarrow \pi\pi$	seen
Γ_8 $f_0(1370)\pi$, $f_0 \rightarrow \pi\pi$	seen
Γ_9 $f_2(1270)\pi$, $f_2 \rightarrow \pi\pi$	seen
Γ_{10} $\pi^+ \pi^- \pi^0$	seen
Γ_{11} $\pi^0 \pi^0 \pi^0$	not seen
Γ_{12} $KK\pi$	seen
Γ_{13} $K^*(892)K$	seen
Γ_{14} $\pi\gamma$	seen

NODE=M010215;NODE=M010

DESIG=17;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
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 DESIG=9;OUR EST;→ UNCHECKED ←
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$a_1(1260)$ PARTIAL WIDTHS

$\Gamma(\pi\gamma)$	VALUE (keV)	DOCUMENT ID	TECN	COMMENT	Γ_{14}	
	640 ± 246	ZIELINSKI	84C	SPEC	200 $\pi^+ Z \rightarrow Z3\pi$	

NODE=M010220

NODE=M010W4
 NODE=M010W4

D-wave/S-wave AMPLITUDE RATIO IN DECAY OF $a_1(1260) \rightarrow \rho\pi$

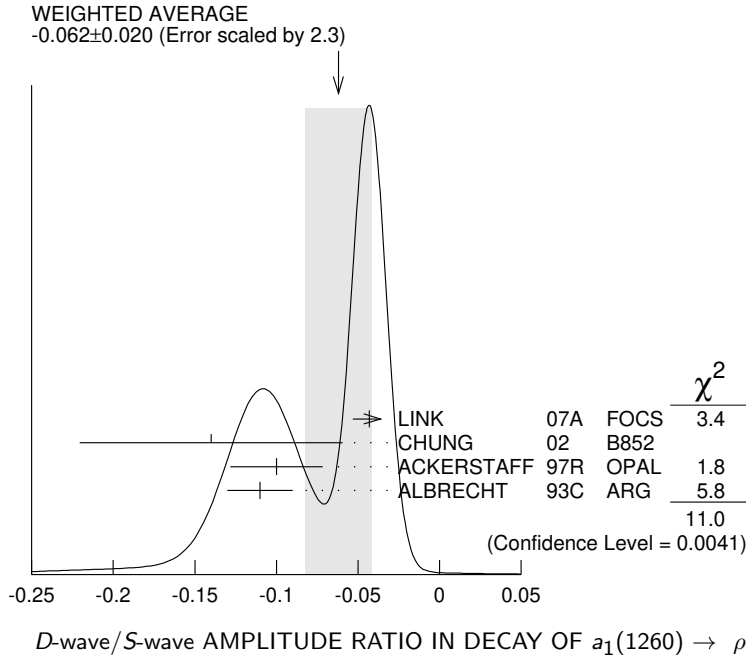
NODE=M010DS

VALUE	DOCUMENT ID	TECN	COMMENT
-0.062 ± 0.020 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
-0.043 ± 0.009 ± 0.005	LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
-0.14 ± 0.04 ± 0.07	¹ CHUNG	02	B852 $18.3 \pi^- \rho \rightarrow \pi^+ \pi^- \pi^- \rho$
-0.10 ± 0.02 ± 0.02	^{2,3} ACKERSTAFF	97R	OPAL $E_{cm}^{e^+e^-} = 88-94, \tau \rightarrow 3\pi\nu$
-0.11 ± 0.02	² ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

NODE=M010DS

- ¹ Deck-type background not subtracted.
- ² Uses the model of ISGUR 89.
- ³ Supersedes AKERS 95P.

NODE=M010DS;LINKAGE=C
 NODE=M010DS;LINKAGE=IM
 NODE=M010DS;LINKAGE=X



$a_1(1260)$ BRANCHING RATIOS

$\Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
60.19	37k	¹ ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

¹ From a fit to the Dalitz plot.

$\Gamma((\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.30 \pm 0.60 \pm 0.22$	37k	¹ ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

¹ From a fit to the Dalitz plot.

$\Gamma((\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.56 \pm 0.84 \pm 0.32$	37k	^{1,2} ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

¹ From a fit to the Dalitz plot.

² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.

$\Gamma((\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.04 \pm 1.20 \pm 0.28$	37k	^{1,2} ASNER	00	CLE2 10.6 $e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

¹ From a fit to the Dalitz plot.

² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.

NODE=M010225

NODE=M010R5
 NODE=M010R5

NODE=M010R5;LINKAGE=B1

NODE=M010R6
 NODE=M010R6

NODE=M010R6;LINKAGE=B1

NODE=M010R7
 NODE=M010R7

NODE=M010R7;LINKAGE=B1
 NODE=M010R7;LINKAGE=B2

NODE=M010R8
 NODE=M010R8

NODE=M010R8;LINKAGE=B1
 NODE=M010R8;LINKAGE=B2

$\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
seen		CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$18.76 \pm 4.29 \pm 1.48$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R9
NODE=M010R9¹ From a fit to the Dalitz plot.² Assuming for $f_0(500)$ (σ) mass and width of 860 and 880 MeV respectively.NODE=M010R9;LINKAGE=B1
NODE=M010R9;LINKAGE=B3 $\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/[\Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) + \Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi)]$ $\Gamma_6/(\Gamma_2+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.06 ± 0.05	90k	SALVINI	04	OBLX $\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
~ 0.3	28k	AKHMETSHIN	99E	CMD2 $1.05\text{--}1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$
0.003 ± 0.003		¹ LONGACRE	82	RVUE

NODE=M010R4
NODE=M010R4¹ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVIL-LET 77, DAUM 80, and DANKOWYCH 81.

NODE=M010R4;LINKAGE=E

 $\Gamma(f_0(980)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		¹ ALEXEEV	21	COMP $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
not seen	37k	ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R10
NODE=M010R10¹ The $a_1(1260)^- \rightarrow f_0(980)\pi^-$ decay mode via the Triangle Singularity mechanism from MIKHASENKO 15 and ACETI 16 explains the $a_1(1420)^-$ signal observed by ADOLPH 15C.

NODE=M010R10;LINKAGE=A

 $\Gamma(f_0(1370)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$7.40 \pm 2.71 \pm 1.26$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R11
NODE=M010R11¹ From a fit to the Dalitz plot.² Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively.NODE=M010R11;LINKAGE=B1
NODE=M010R11;LINKAGE=B4 $\Gamma(f_2(1270)\pi, f_2 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1.19 \pm 0.49 \pm 0.17$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R12
NODE=M010R12¹ From a fit to the Dalitz plot.² Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively.NODE=M010R12;LINKAGE=B1
NODE=M010R12;LINKAGE=B5 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	COMMENT
seen	BARBERIS 98B	450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$

NODE=M010R00
NODE=M010R00 $\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_{11}/Γ_{10}

VALUE	CL%	DOCUMENT ID	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
< 0.008	90	¹ BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$

NODE=M010R15
NODE=M010R15¹ Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.

NODE=M010R15;LINKAGE=RB

$\Gamma(K^*(892)K)/\Gamma_{total}$ Γ_{13}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.2±0.5	2255	¹ COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$
8 to 15	205	² DRUTSKOY	02	BELL $B \rightarrow D^{(*)} K^- K^{*0}$
3.3±0.5±0.1	37k	³ ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
2.6±0.3		⁴ BARATE	99R	ALEP $\tau \rightarrow K \bar{K} \pi \nu_\tau$

¹ Using structure functions from KUHN 92 and DECKER 93A and $B(\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau) = (0.155 \pm 0.006 \pm 0.009)\%$ from BRIERE 03.

² From a comparison to ALAM 94 assuming purely resonant production of the $K^- K^{*0}$ system.

³ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.

⁴ Assuming $a_1(1260)$ dominance and taking $B(\tau \rightarrow a_1(1260) \nu_\tau)$ from BUSKULIC 96.

NODE=M010R13
NODE=M010R13

NODE=M010R13;LINKAGE=CO

NODE=M010R13;LINKAGE=DR

NODE=M010R13;LINKAGE=B6

NODE=M010R13;LINKAGE=BA

$a_1(1260)$ REFERENCES

ALEXEEV	21	PRL 127 082501	G.D. Alexeev <i>et al.</i>	(COMPASS Collab.)
AAJ	18A1	EPJ C78 443	R. Aajj <i>et al.</i>	(LHCb Collab.)
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
MIKHASENKO	18	PR D98 096021	M. Mikhasenko <i>et al.</i>	(JPAC Collab.)
DARGENT	17	JHEP 1705 143	P. dArgent <i>et al.</i>	(HEID, BRIS)
ACETI	16	PR D94 096015	F. Aceti, L.R. Dai, E. Oset	(IFIC, LNUDA)
ADOLPH	15C	PRL 115 082001	C. Adolph <i>et al.</i>	(COMPASS Collab.)
MIKHASENKO	15	PR D91 094015	M. Mikhasenko, B. Ketzner, A. Sarantsev	(BONN+)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK	07A	PR D75 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GOMEZ-DUM...	04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BRIERE	03	PRL 90 181802	R. A. Briere <i>et al.</i>	(CLEO Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
DRUTSKOY	02	PL B542 171	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	99E	PL B466 392	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BONDAR	99	PL B466 403	A.E. Bondar <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE	98R	EPJ C4 409	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACKERSTAFF	97R	ZPHY C75 593	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BUSKULIC	96	ZPHY C70 579	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
AKERS	95P	ZPHY C67 45	R. Akers <i>et al.</i>	(OPAL Collab.)
ALAM	94	PR D50 43	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT	93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER	93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN	92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV	91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT	90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR	89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER	88	PL B209 99	M.G. Bowler	(OXF)
BAND	87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST	87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT	86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL	86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE	86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
ZIELINSKI	84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE	82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
GAVILLET	77	PL 69B 119	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJM+) JP
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M010

REFID=62008

REFID=59187

REFID=59471

REFID=59487

REFID=58121

REFID=62015

REFID=56790

REFID=56825

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REFID=20882

REFID=20878

REFID=20572

REFID=20872

REFID=20868

REFID=20852

REFID=20571

$f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M005

 $f_2(1270)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M005PP

NODE=M005PP

NODE=M005PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1260–1283) – i (90–110) OUR ESTIMATE			
$(1268 \pm 8) - i (101 \pm 6)$	RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1263.3 \pm 0.2 \pm 1.5) - i$ $(96.9 \pm 0.2 \pm 0.8)$	ALBRECHT	20	RVUE $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$ $\pi^0K^+K^-$
$(1270 \pm 8) - i (97 \pm 8)$	¹ ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1278 \pm 5) - i (102 \pm 10)$	¹ BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

¹ Amplitude did not include dispersive corrections.

NODE=M005PP;LINKAGE=A

 $f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.4 ± 0.8 OUR AVERAGE				
Error includes scale factor of 1.1.				
$1275.8 \pm 1.0 \pm 0.4$		¹ BOGOLYUB...	13	SPEC $7\pi^+(K^+,p)A \rightarrow n\gamma + X$
$1262 \pm \frac{1}{2} \pm 8$		² ABLIKIM	06v	BES2 $e^+e^- \rightarrow J/\psi \rightarrow$ $\gamma\pi^+\pi^-$
1275 ± 15		ABLIKIM	05	BES2 $J/\psi \rightarrow \phi\pi^+\pi^-$
1283 ± 5		ALDE	98	GAM4 $100 \pi^-p \rightarrow \pi^0\pi^0n$
1272 ± 8	200k	PROKOSHKIN	94	GAM2 $38 \pi^-p \rightarrow \pi^0\pi^0n$
1269.7 ± 5.2	5730	AUGUSTIN	89	DM2 $e^+e^- \rightarrow 5\pi$
1283 ± 8	400	³ ALDE	87	GAM4 $100 \pi^-p \rightarrow 4\pi^0n$
1274 ± 5		³ AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		⁴ LONGACRE	86	MPS $22 \pi^-p \rightarrow n2K_S^0$
1276 ± 7		COURAU	84	DLCO $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ± 2.3		⁵ CHABAUD	83	ASPK $17 \pi^-p$ polarized
1280 ± 4		⁶ CASON	82	STRC $8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81	MRK2 J/ψ decay
1282 ± 5		⁷ CORDEN	79	OMEG $12-15 \pi^-p \rightarrow n2\pi$
1269 ± 4	10k	APEL	75	NICE $40 \pi^-p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER	74	DBC $6 \pi^+n \rightarrow \pi^+\pi^-p$
1277 ± 4	5300	FLATTE	71	HBC $7.0 \pi^+p$
1273 ± 8		³ STUNTEBECK	70	HBC $8 \pi^-p, 5.4 \pi^+d$
1265 ± 8		BOESEBECK	68	HBC $8 \pi^+p$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1257 ± 6		⁸ KLEMP	22	RVUE $J/\psi(1S) \rightarrow \gamma\pi^0\pi^0,$ $\gamma K_S^0 K_S^0$
1263 ± 12		CARVER	21	CLAS $\gamma p \rightarrow \pi^0\pi^0p$
$1259 \pm 4 \pm 4$	1.7k	^{9,10} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
$1267 \pm 4 \pm 3$	1.5k	^{9,10} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1277 ± 6	870	¹¹ SCHEGELSKY	06A	RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ± 10		TIKHOMIROV	03	SPEC $40.0 \pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ± 10		¹² ALDE	97	GAM2 $450 pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		¹² GRYGOREV	96	SPEC $40 \pi^-N \rightarrow K_S^0 K_S^0 X$
1262 ± 11		AGUILAR-...	91	EHS $400 pp$
1275 ± 10		AKER	91	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$
1220 ± 10		BREAKSTONE	90	SFM $pp \rightarrow pp\pi^+\pi^-$
1288 ± 12		ABACHI	86B	HRS $e^+e^- \rightarrow \pi^+\pi^-X$
1284 ± 30	3k	BINON	83	GAM2 $38 \pi^-p \rightarrow n2\eta$
1280 ± 20	3k	APEL	82	CNTR $25 \pi^-p \rightarrow n2\pi^0$
1284 ± 10	16000	DEUTSCH...	76	HBC $16 \pi^+p$
1258 ± 10	600	TAKAHASHI	72	HBC $8 \pi^-p \rightarrow n2\pi$
1275 ± 13		ARMENISE	70	HBC $9 \pi^+n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	³ ARMENISE	68	DBC $5.1 \pi^+n \rightarrow p\pi^+MM^-$
1270 ± 10	360	³ ARMENISE	68	DBC $5.1 \pi^+n \rightarrow p\pi^0MM$
1268 ± 6		¹³ JOHNSON	68	HBC $3.7-4.2 \pi^-p$

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.
- ² Breit-Wigner mass.
- ³ Mass errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass.
- ⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- ⁵ From an energy-independent partial-wave analysis.
- ⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
- ⁷ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
- ⁸ Fit of the tensor partial waves from BES3 in the multipole basis.
- ⁹ Using CLEO-c data but not authored by the CLEO Collaboration.
- ¹⁰ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 185$ MeV.
- ¹¹ From analysis of L3 data at 91 and 183–209 GeV.
- ¹² Systematic uncertainties not estimated.
- ¹³ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

NODE=M005M;LINKAGE=B
 NODE=M005M;LINKAGE=K
 NODE=M005M;LINKAGE=T
 NODE=M005M;LINKAGE=L
 NODE=M005M;LINKAGE=O
 NODE=M005M;LINKAGE=P
 NODE=M005M;LINKAGE=S
 NODE=M005M;LINKAGE=Q
 NODE=M005M;LINKAGE=C
 NODE=M005M;LINKAGE=D
 NODE=M005M;LINKAGE=SC
 NODE=M005M;LINKAGE=QQ
 NODE=M005M;LINKAGE=J

$f_2(1270)$ WIDTH

NODE=M005W
 NODE=M005W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

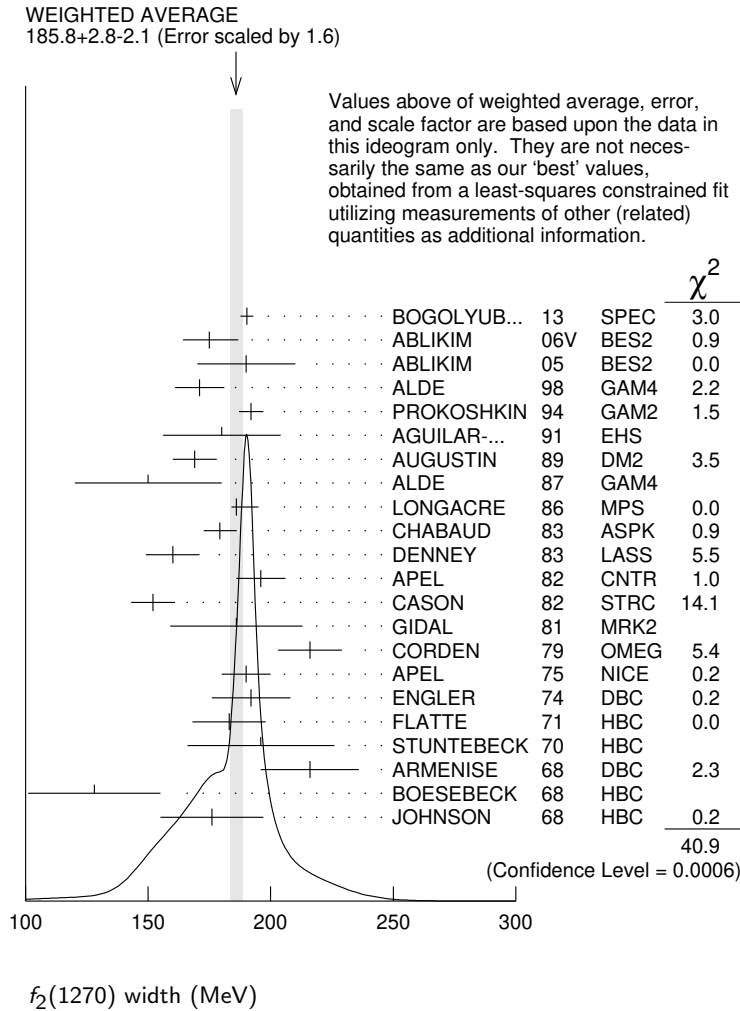
186.6^{+2.8}_{-2.2} OUR FIT Error includes scale factor of 1.5.

185.8^{+2.8}_{-2.1} OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

190.3 ± 1.9 ± 1.8		¹ BOGOLYUB...	13	SPEC	7π ⁺ (K ⁺ ,p)A → nγ + X	
175 ⁺⁶ ₋₄ ± 10		² ABLIKIM	06v	BES2	e ⁺ e ⁻ → J/ψ → γπ ⁺ π ⁻	
190 ± 20		ABLIKIM	05	BES2	J/ψ → φπ ⁺ π ⁻	
171 ± 10		ALDE	98	GAM4	100 π ⁻ p → π ⁰ π ⁰ n	
192 ± 5	200k	PROKOSHKIN	94	GAM2	38 π ⁻ p → π ⁰ π ⁰ n	
180 ± 24		AGUILAR-...	91	EHS	400 pp	
169 ± 9	5730	³ AUGUSTIN	89	DM2	e ⁺ e ⁻ → 5π	
150 ± 30	400	³ ALDE	87	GAM4	100 π ⁻ p → 4π ⁰ n	
186 ⁺⁹ ₋₂		⁴ LONGACRE	86	MPS	22 π ⁻ p → n2K ⁰ _S	
179.2 ^{+6.9} _{-6.6}		⁵ CHABAUD	83	ASPK	17 π ⁻ p polarized	
160 ± 11		DENNEY	83	LASS	10 π ⁺ N	
196 ± 10	3k	APEL	82	CNTR	25 π ⁻ p → n2π ⁰	
152 ± 9		⁶ CASON	82	STRC	8 π ⁺ p → Δ ⁺⁺ π ⁰ π ⁰	
186 ± 27	11600	GIDAL	81	MRK2	J/ψ decay	
216 ± 13		⁷ CORDEN	79	OMEG	12–15 π ⁻ p → n2π	
190 ± 10	10k	APEL	75	NICE	40 π ⁻ p → n2π ⁰	
192 ± 16	4600	ENGLER	74	DBC	6 π ⁺ n → π ⁺ π ⁻ p	
183 ± 15	5300	FLATTE	71	HBC	7 π ⁺ p → Δ ⁺⁺ f ₂	
196 ± 30		³ STUNTEBECK	70	HBC	8 π ⁻ p, 5.4 π ⁺ d	
216 ± 20	1960	³ ARMENISE	68	DBC	5.1 π ⁺ n → pπ ⁺ MM ⁻	OCCUR=2
128 ± 27		³ BOESEBECK	68	HBC	8 π ⁺ p	
176 ± 21		^{3,8} JOHNSON	68	HBC	3.7–4.2 π ⁻ p	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
168 ± 7		⁹ KLEMP	22	RVUE	J/ψ(1S) → γπ ⁰ π ⁰ , γK ⁰ _S K ⁰ _S	
183 ± 2		CARVER	21	CLAS	γp → π ⁰ π ⁰ p	
195 ± 15	870	¹⁰ SCHEGELSKY	06A	RVUE	γγ → K ⁰ _S K ⁰ _S	
121 ± 26		TIKHOMIROV	03	SPEC	40.0 π ⁻ C → K ⁰ _S K ⁰ _S K ⁰ _L X	
187 ± 20		¹¹ ALDE	97	GAM2	450 pp → ppπ ⁰ π ⁰	
184 ± 10		¹¹ GRYGOREV	96	SPEC	40 π ⁻ N → K ⁰ _S K ⁰ _S X	
200 ± 10		AKER	91	CBAR	0.0 p̄p → 3π ⁰	
240 ± 40	3k	BINON	83	GAM2	38 π ⁻ p → n2η	
187 ± 30	650	³ ANTIPOV	77	CIBS	25 π ⁻ p → p3π	
225 ± 38	16000	DEUTSCH...	76	HBC	16 π ⁺ p	
166 ± 28	600	³ TAKAHASHI	72	HBC	8 π ⁻ p → n2π	
173 ± 53		³ ARMENISE	70	HBC	9 π ⁺ n → pπ ⁺ π ⁻	OCCUR=2

- 1 Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.
- 2 Breit-Wigner width
- 3 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- 4 From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- 5 From an energy-independent partial-wave analysis.
- 6 From an amplitude analysis of the reaction $\pi^+\pi^-\rightarrow 2\pi^0$.
- 7 From an amplitude analysis of $\pi^+\pi^-\rightarrow \pi^+\pi^-$ scattering data.
- 8 JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
- 9 Fit of the tensor partial waves from BES3 in the multipole basis.
- 10 From analysis of L3 data at 91 and 183–209 GeV.
- 11 Systematic uncertainties not estimated.

NODE=M005W;LINKAGE=C
 NODE=M005W;LINKAGE=D
 NODE=M005W;LINKAGE=T
 NODE=M005W;LINKAGE=L
 NODE=M005W;LINKAGE=R
 NODE=M005W;LINKAGE=Q
 NODE=M005W;LINKAGE=U
 NODE=M005W;LINKAGE=J
 NODE=M005W;LINKAGE=M
 NODE=M005W;LINKAGE=SC
 NODE=M005W;LINKAGE=QQ



$f_2(1270)$ DECAY MODES

NODE=M005215;NODE=M005

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 $\pi\pi$	(84.3 $^{+2.8}_{-1.0}$) %	S=1.2	DESIG=1
Γ_2 $\pi^+\pi^-2\pi^0$	(7.7 $^{+1.2}_{-3.1}$) %	S=1.2	DESIG=3
Γ_3 $K\bar{K}$	(4.6 ± 0.4) %	S=2.7	DESIG=4
Γ_4 $2\pi^+2\pi^-$	(2.8 ± 0.4) %	S=1.2	DESIG=2
Γ_5 $\eta\eta$	(4.0 ± 0.8) $\times 10^{-3}$	S=2.1	DESIG=7
Γ_6 $4\pi^0$	(3.0 ± 1.0) $\times 10^{-3}$		DESIG=9
Γ_7 $\gamma\gamma$	(1.42 ± 0.24) $\times 10^{-5}$	S=1.4	DESIG=8
Γ_8 $\eta\pi\pi$	< 8 $\times 10^{-3}$	CL=95%	DESIG=6
Γ_9 $K^0K^-\pi^+$ + c.c.	< 3.4 $\times 10^{-3}$	CL=95%	DESIG=5
Γ_{10} e^+e^-	< 6 $\times 10^{-10}$	CL=90%	DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 44 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 82.3$ for 37 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-91						
x_3	10	-39					
x_4	10	-38	1				
x_5	1	-6	0	0			
x_6	0	-7	0	0	0		
x_7	4	1	-15	0	0	0	
Γ	-72	66	-10	-7	-1	0	-6
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $\pi\pi$	157.2 $^{+5.0}_{-1.0}$	
Γ_2 $\pi^+\pi^-2\pi^0$	14.3 $^{+2.3}_{-6.0}$	1.3
Γ_3 $K\bar{K}$	8.5 ± 0.8	2.8
Γ_4 $2\pi^+2\pi^-$	5.2 ± 0.7	1.2
Γ_5 $\eta\eta$	0.75 ± 0.14	2.1
Γ_6 $4\pi^0$	0.56 ± 0.19	
Γ_7 $\gamma\gamma$	0.0026 ± 0.0005	1.4

$f_2(1270)$ PARTIAL WIDTHS

NODE=M005220

$\Gamma(\pi\pi)$

 Γ_1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

NODE=M005W1
NODE=M005W1

157.2 $^{+5.0}_{-1.0}$ OUR FIT

157.0 $^{+6.0}_{-1.0}$

¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

••• We do not use the following data for averages, fits, limits, etc. •••

152 ± 8 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

NODE=M005W1;LINKAGE=L
NODE=M005W1;LINKAGE=SC

$\Gamma(K\bar{K})$

 Γ_3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

NODE=M005W4
NODE=M005W4

8.5 ± 0.8 OUR FIT Error includes scale factor of 2.8.

9.0 $^{+0.7}_{-0.3}$

¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

••• We do not use the following data for averages, fits, limits, etc. •••

7.5 ± 2.0 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

NODE=M005W4;LINKAGE=L
NODE=M005W4;LINKAGE=SC

$\Gamma(\eta\eta)$

 Γ_5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M005W7
NODE=M005W7

0.75 ± 0.14 OUR FIT Error includes scale factor of 2.1.

1.0 ± 0.1

¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

••• We do not use the following data for averages, fits, limits, etc. •••

1.8 ± 0.4 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

NODE=M005W7;LINKAGE=L
NODE=M005W7;LINKAGE=SC

$\Gamma(\gamma\gamma)$ Γ_7

The value of this width depends on the theoretical model used. Unitary approaches with scalars typically (with exception of PENNINGTON 08) give values clustering around 2.6 keV; without an S -wave contribution, values are systematically higher (typically around 3 keV).

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.5 OUR FIT	Error includes scale factor of 1.4.			
2.93 ± 0.40		¹ DAI	14A	RVUE Compilation
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3.14 ± 0.20		^{2,3} PENNINGTON 08		RVUE Compilation
3.82 ± 0.30		^{3,4} PENNINGTON 08		RVUE Compilation
2.55 ± 0.15	870	⁵ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84 ± 0.35		BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
2.93 ± 0.23 ± 0.32		⁶ YABUKI 95	VNS	
2.58 ± 0.13 ^{+0.36} _{-0.27}		⁷ BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.10 ± 0.35 ± 0.35		⁸ BLINOV 92	MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.27 ± 0.47 ± 0.11		ADACHI 90D	TOPZ	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.15 ± 0.04 ± 0.39		BOYER 90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.19 ± 0.16 ^{+0.29} _{-0.28}		MARSISKE 90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2.35 ± 0.65		⁹ MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
3.19 ± 0.09 ^{+0.22} _{-0.38}	2177	OEST 90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
3.2 ± 0.1 ± 0.4		¹⁰ AIHARA 86B	TPC	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.5 ± 0.1 ± 0.5		BEHREND 84B	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.85 ± 0.25 ± 0.5		¹¹ BERGER 84	PLUT	$e^+ e^- \rightarrow e^+ e^- 2\pi$
2.70 ± 0.05 ± 0.20		COURAU 84	DLCO	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.52 ± 0.13 ± 0.38		¹² SMITH 84C	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.7 ± 0.2 ± 0.6		EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
2.9 ^{+0.6} _{-0.4} ± 0.6		¹³ EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
3.2 ± 0.2 ± 0.6		BRANDELIK 81B	TASS	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.6 ± 0.3 ± 0.5		ROUSSARIE 81	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.3 ± 0.8		¹⁴ BERGER 80B	PLUT	$e^+ e^-$

NODE=M005W8

NODE=M005W8

NODE=M005W8

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M005W8;LINKAGE=A

NODE=M005W8;LINKAGE=P1

NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

NODE=M005W8;LINKAGE=SC

NODE=M005W8;LINKAGE=YA

NODE=M005W;LINKAGE=B

NODE=M005W;LINKAGE=A

NODE=M005PW;LINKAGE=C

NODE=M005PW;LINKAGE=B

NODE=M005PW;LINKAGE=X

NODE=M005PW;LINKAGE=V

NODE=M005PW;LINKAGE=H

NODE=M005PW;LINKAGE=A

¹ Based on a K -matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis. Supersedes PENNINGTON 08.

² Solution A (preferred solution based on χ^2 -analysis).

³ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁴ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

⁵ From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

⁶ With a narrow scalar state around 1220 MeV.

⁷ Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.

⁸ Using the unitarized model of LYTH 85.

⁹ Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4 \Gamma(f^0) = 3.6 \pm 0.3$ KeV.

¹⁰ Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.

¹¹ Using the MENNESSIER 83 model.

¹² Superseded by BOYER 90.

¹³ If helicity = 2 assumption is not made.

¹⁴ Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.

 $\Gamma(e^+ e^-)$ Γ_{10}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.11	90	ACHASOV	00K	SNL $e^+ e^- \rightarrow \pi^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<1.7	90	VOROBYEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M005W9

NODE=M005W9

$f_2(1270) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M005223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_7/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.121±0.020 OUR FIT			Error includes scale factor of 1.3.
0.091±0.007±0.027	¹ ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
••• We do not use the following data for averages, fits, limits, etc. •••			
0.104±0.007±0.072	² ALBRECHT	90G ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
¹ Using an incoherent background.			
² Using a coherent background.			

NODE=M005G1
NODE=M005G1 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_7/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
11.5^{+1.8+4.5}_{-2.0-3.7}	¹ UEHARA	10A BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$

OCCUR=2

NODE=M005G1;LINKAGE=A
NODE=M005G1;LINKAGE=KNODE=M005G02
NODE=M005G02

¹ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(Y)$.

NODE=M005G02;LINKAGE=UE

Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
3.7±0.3^{+15.9}_{-2.9}	UEHARA	08A BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
••• We do not use the following data for averages, fits, limits, etc. •••			
9.5±1.8	¹ DAI	14A RVUE	Compilation
13	^{2,3} PENNINGTON 08	RVUE	Compilation
26	^{3,4} PENNINGTON 08	RVUE	Compilation
¹ Based on a K -matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis.			
² Solution A (preferred solution based on χ^2 -analysis).			
³ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.			
⁴ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).			

NODE=M005HR0
NODE=M005HR0

OCCUR=2

OCCUR=3

NODE=M005HR0;LINKAGE=A

NODE=M005HR0;LINKAGE=P1
NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

 $f_2(1270)$ BRANCHING RATIOS

NODE=M005225

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.843^{+0.028}_{-0.010} OUR FIT				Error includes scale factor of 1.2.
0.837±0.020 OUR AVERAGE				
0.849±0.025		CHABAUD	83 ASPK	17 π^-p polarized
0.85 ±0.05	250	BEAUPRE	71 HBC	8 $\pi^+p \rightarrow \Delta^{++}f_2$
0.8 ±0.04	600	OH	70 HBC	1.26 $\pi^-p \rightarrow \pi^+\pi^-n$
••• We do not use the following data for averages, fits, limits, etc. •••				
0.856±0.001±0.05		¹ ALBRECHT	20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta,$ $\pi^0\eta\eta, \pi^0K^+K^-$
¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 (KK), BINON 83 ($\eta\eta$).				

NODE=M005R10
NODE=M005R10

NODE=M005R10;LINKAGE=A

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi\pi)$ Γ_2/Γ_1 Should be twice $\Gamma(2\pi^+2\pi^-)/\Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.091^{+0.015}_{-0.040} OUR FIT				Error includes scale factor of 1.2.
0.15 ±0.06	600	EISENBERG	74 HBC	4.9 $\pi^+p \rightarrow \Delta^{++}f_2$
••• We do not use the following data for averages, fits, limits, etc. •••				
0.07		EMMS	75D DBC	4 $\pi^+n \rightarrow \rho f_2$

NODE=M005R2

NODE=M005R2
NODE=M005R2 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.033±0.001±0.005	¹ ALBRECHT	20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta,$ $\pi^0\eta\eta, \pi^0K^+K^-$

NODE=M005R00
NODE=M005R00

¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 (KK), BINON 83 ($\eta\eta$).

NODE=M005R00;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_3/Γ_1

We average only experiments which either take into account $f_2(1270)$ - $a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M005R3

NODE=M005R3

NODE=M005R3

0.054^{+0.005}_{-0.006} OUR FIT Error includes scale factor of 2.7.

0.041^{+0.004}_{-0.005} OUR AVERAGE

0.045±0.01		¹ BARGIOTTI	03	OBLX	$\bar{p}p$
0.037 ^{+0.008} _{-0.021}		ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2K_S^0$
0.045±0.009		CHABAUD	81	ASPK	$17 \pi^- p$ polarized
0.039±0.008		LOVERRE	80	HBC	$4 \pi^- p \rightarrow K\bar{K}N$
0.052±0.025		ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
0.036±0.005		² COSTA	80	OMEG	$1-2.2 \pi^- p \rightarrow K^+ K^- n$
0.030±0.005		³ MARTIN	79	RVUE	
0.027±0.009		⁴ POLYCHRO...	79	STRC	$7 \pi^- p \rightarrow n 2K_S^0$
0.025±0.015		EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.031±0.012	20	ADERHOLZ	69	HBC	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

² Re-evaluated by CHABAUD 83.

³ Includes PAWLICKI 77 data.

⁴ Takes into account the $f_2(1270)$ - $f_2'(1525)$ interference.

NODE=M005R;LINKAGE=BG

NODE=M005R3;LINKAGE=D

NODE=M005R3;LINKAGE=F

NODE=M005R3;LINKAGE=M

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M005R1

NODE=M005R1

0.033±0.005 OUR FIT Error includes scale factor of 1.2.

0.033±0.004 OUR AVERAGE Error includes scale factor of 1.1.

0.024±0.006	160	EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
0.051±0.025	70	EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$
0.043 ^{+0.007} _{-0.011}	285	¹ LOUIE	74	HBC	$3.9 \pi^- p \rightarrow n f_2$
0.037±0.007	154	ANDERSON	73	DBC	$6 \pi^+ n \rightarrow p f_2$
0.047±0.013		OH	70	HBC	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

¹ LOUIE 74 was quoted as 0.065 in PDG 74. Factor 2/3 to go from $\pi^+ \pi^- \rightarrow \pi\pi$ forgotten. Mike L.

NODE=M005R1;LINKAGE=02

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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NODE=M005R7

NODE=M005R7

4.0±0.8 OUR FIT Error includes scale factor of 2.1.

2.9±0.5 OUR AVERAGE

2.7±0.7		BINON	05	GAMS	$33 \pi^- p \rightarrow \eta\eta n$
2.8±0.7		ALDE	86D	GAM4	$100 \pi^- p \rightarrow 2\eta n$
5.2±1.7		BINON	83	GAM2	$38 \pi^- p \rightarrow 2\eta n$
4.0±1.0±2.0		¹ ALBRECHT	20	RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta\eta, \pi^0 K^+ K^-$

¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M005R7;LINKAGE=A

 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M005R6

NODE=M005R6

0.003±0.001

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.05	95	EDWARDS	82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\eta$
<0.016	95	EMMS	75D	DBC	$4 \pi^+ n \rightarrow p f_2$
<0.09	95	EISENBERG	74	HBC	$4.9 \pi^+ p \rightarrow \Delta^{++} f_2$

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M005R11

NODE=M005R11

0.0030±0.0010 OUR FIT

0.003 ±0.001 400 ± 50 ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

 Γ_7/Γ NODE=M005R13
NODE=M005R13

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $1.57 \pm 0.01^{+1.39}_{-0.14}$

UEHARA

08A BELL

 $10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$ $\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$

VALUE CL%

DOCUMENT ID

TECN

COMMENT

 Γ_8/Γ_1 NODE=M005R5
NODE=M005R5

<0.010

95

EMMS

75D

DBC

 $4 \pi^+ n \rightarrow p f_2$ $\Gamma(K^0 K^- \pi^+ + \text{c.c.})/\Gamma(\pi\pi)$

VALUE CL%

DOCUMENT ID

TECN

COMMENT

 Γ_9/Γ_1 NODE=M005R4
NODE=M005R4

<0.004

95

EMMS

75D

DBC

 $4 \pi^+ n \rightarrow p f_2$ $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-10})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{10}/Γ NODE=M005R12
NODE=M005R12

<6

90

ACHASOV

00K

SND

 $e^+ e^- \rightarrow \pi^0 \pi^0$ **f₂(1270) REFERENCES**

NODE=M005

KLEMP	22	PL B830 137171	E. Klempt <i>et al.</i>	(BONN)	REFID=61646
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
CARVER	21	PRL 126 082002	M. Carver <i>et al.</i>	(CLAS Collab.)	REFID=61097
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)	REFID=55923
BOGOLYUB...	13	PAN 76 1324	M.Yu. Bogolyubsky <i>et al.</i>	(HYPERON-M Collab.)	REFID=55585
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>		REFID=52303
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BOGLIONE	99	EPJ C9 11	M. Boggione, M.R. Pennington		REFID=46931
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)	REFID=45566
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)	REFID=46384
PROKOSHKIN	94	PD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)	REFID=44094
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41858
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)	REFID=41345
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JP G11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
		Translated from YAF 38 934.			

CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>	
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)
DEUTSCH...	76	NP B103 426	M. Deuschmann <i>et al.</i>	(AACH3, BERL, BONN+)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
EISENBERG	74	PL 52B 239	Y. Eisenberg <i>et al.</i>	(REHO)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)
LOUIE	74	PL 48B 385	J. Louie <i>et al.</i>	(SACL, CERN)
PDG	74	PL 50B 1	V. Chaloupka <i>et al.</i>	
ANDERSON	73	PRL 31 562	J.C. Anderson <i>et al.</i>	(CMU, CASE)
TAKAHASHI	72	PR D6 1266	K. Takahashi <i>et al.</i>	(TOHOK, PENN, NDAM+)
BEAUPRE	71	NP B28 77	J.V. Beaupre <i>et al.</i>	(AACH, BERL, CERN)
FLATTE	71	PL 34B 551	S.M. Flatte <i>et al.</i>	(LBL)
ARMENISE	70	LCN 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
OH	70	PR D1 2494	B.Y. Oh <i>et al.</i>	(WISC, TINTO) JP
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)
LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)

REFID=20131
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NODE=M008

$f_1(1285)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

$f_1(1285)$ MASS

NODE=M008M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1281.8 ± 0.5	OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.		
1280.2 ± 0.6	$^{+1.2}_{-1.5}$ 126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1281.0 ± 0.8		DICKSON	16 CLAS	2.55 $\gamma p \rightarrow \eta \pi^+ \pi^- p$
1287.4 ± 3.0	87	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
1281.16 ± 0.39 ± 0.45		¹ LEES	12X BABR	$\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
1285.1 ± 1.0	$^{+1.6}_{-0.3}$	² ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
1281 ± 2 ± 1		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
1276.1 ± 8.1 ± 8.0	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
1274 ± 6	237	ABDALLAH	03H DLPH	91.2 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1280 ± 4		ACCIARRI	01G L3	
1288 ± 4 ± 5	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1284 ± 6	1400	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1281 ± 1		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1281 ± 1		BARBERIS	97C OMEG	450 $pp \rightarrow ppK_S^0 K^\pm \pi^\mp$
1280 ± 2		³ ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1282.2 ± 1.5		LEE	94 MPS2	18 $\pi^- p \rightarrow K^+ K^0 2\pi^- p$
1279 ± 5		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M008M

1278	± 2	140	ARMSTRONG	89	OMEG	300	$pp \rightarrow K\bar{K}\pi pp$		
1278	± 2		ARMSTRONG	89G	OMEG	85	$\pi^+ p \rightarrow 4\pi\pi p,$ $pp \rightarrow 4\pi pp$		
1280.1	± 2.1	60	RATH	89	MPS	21.4	$\pi^- p \rightarrow$ $K_S^0 K_S^0 \pi^0 n$		
1285	± 1	4750	⁴ BIRMAN	88	MPS	8	$\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$		
1280	± 1	504	BITYUKOV	88	SPEC	32.5	$\pi^- p \rightarrow$ $K^+ K^- \pi^0 n$		
1280	± 4		ANDO	86	SPEC	8	$\pi^- p \rightarrow \eta\pi^+ \pi^- n$		
1277	± 2	420	REEVES	86	SPEC	6.6	$p\bar{p} \rightarrow KK\pi X$		
1285	± 2		CHUNG	85	SPEC	8	$\pi^- p \rightarrow NK\bar{K}\pi$		
1279	± 2	604	ARMSTRONG	84	OMEG	85	$\pi^+ p \rightarrow K\bar{K}\pi\pi p,$ $pp \rightarrow K\bar{K}\pi pp$		
1286	± 1		CHAUVAT	84	SPEC	ISR 31.5	pp		
1278	± 4		EVANGELIS...	81	OMEG	12	$\pi^- p \rightarrow$ $\eta\pi^+ \pi^- \pi^- p$		
1283	± 3	103	DIONISI	80	HBC	4	$\pi^- p \rightarrow K\bar{K}\pi n$		
1282	± 2	320	NACASCH	78	HBC	0.7,0.76	$\bar{p}p \rightarrow K\bar{K}3\pi$		
1279	± 5	210	GRASSLER	77	HBC	16	$\pi^\mp p$		
1286	± 3	180	DUBOC	72	HBC	1.2	$\bar{p}p \rightarrow 2K4\pi$		
1283	± 5		DAHL	67	HBC	1.6-4.2	$\pi^- p$		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●									
1289.3	± 2.8	234	ABLIKIM	19BA	BES3		$e^+ e^- \rightarrow \psi(2S)$		
1284.2	± 2.2		⁵ AAIJ	14Y	LHCB		$\bar{B}_{(s)}^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$		
1281.9	± 0.5		⁵ SOSA	99	SPEC		$pp \rightarrow p_{\text{slow}}$ $(K_S^0 K^+ \pi^-) p_{\text{fast}}$		
1282.8	± 0.6		⁵ SOSA	99	SPEC		$pp \rightarrow p_{\text{slow}}$ $(K_S^0 K^- \pi^+) p_{\text{fast}}$	OCCUR=2	
1270	± 10		AMELIN	95	VES	37	$\pi^- N \rightarrow$ $\pi^- \pi^+ \pi^- \gamma N$		
1280	± 2		ABATZIS	94	OMEG	450	$pp \rightarrow pp2(\pi^+ \pi^-)$		
1282	± 4		ARMSTRONG	93C	E760		$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$		
1270	± 6	± 10	ARMSTRONG	92C	OMEG	300	$pp \rightarrow pp\pi^+ \pi^- \gamma$		
1281	± 1		ARMSTRONG	89E	OMEG	300	$pp \rightarrow pp2(\pi^+ \pi^-)$		
1279	± 6	± 10	BECKER	87	MRK3		$e^+ e^- \rightarrow \phi K\bar{K}\pi$		
1286	± 9	16	GIDAL	87	MRK2		$e^+ e^- \rightarrow$ $e^+ e^- \eta \pi^+ \pi^-$		
1287	± 5	353	BITYUKOV	84B	SPEC	32	$\pi^- p \rightarrow K^+ K^- \pi^0 n$		
~ 1279			⁶ TORNQVIST	82B	RVUE				
1275	± 6	31	BROMBERG	80	SPEC	100	$\pi^- p \rightarrow K\bar{K}\pi X$		
1288	± 9	200	GURTU	79	HBC	4.2	$K^- p \rightarrow n\eta 2\pi$		
~ 1275.0		46	⁷ STANTON	79	CNTR	8.5	$\pi^- p \rightarrow n2\gamma 2\pi$		
1271	± 10	34	CORDEN	78	OMEG	12-15	$\pi^- p \rightarrow$ $K^+ K^- \pi n$		
1295	± 12	85	CORDEN	78	OMEG	12-15	$\pi^- p \rightarrow n5\pi$	OCCUR=2	
1292	± 10	150	DEFOIX	72	HBC	0.7	$\bar{p}p \rightarrow 7\pi$		
1280	± 3	500	⁸ THUN	72	MMS	13.4	$\pi^- p$		
1303	± 8		BARDADIN-...	71	HBC	8	$\pi^+ p \rightarrow p6\pi$		
1283	± 6		BOESEBECK	71	HBC	16.0	$\pi p \rightarrow p5\pi$		
1270	± 10		CAMPBELL	69	DBC	2.7	$\pi^+ d$		
1285	± 7		LORSTAD	69	HBC	0.7	$\bar{p}p, 4,5\text{-body}$		
1290	± 7		D'ANDLAU	68	HBC	1.2	$\bar{p}p, 5-6\text{ body}$		

¹ Using the $2\pi^+ 2\pi^-$ and $\pi^+ \pi^- \eta$ modes of $f_1(1285)$ decay.

² The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

³ Supersedes ABATZIS 94, ARMSTRONG 89E.

⁴ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

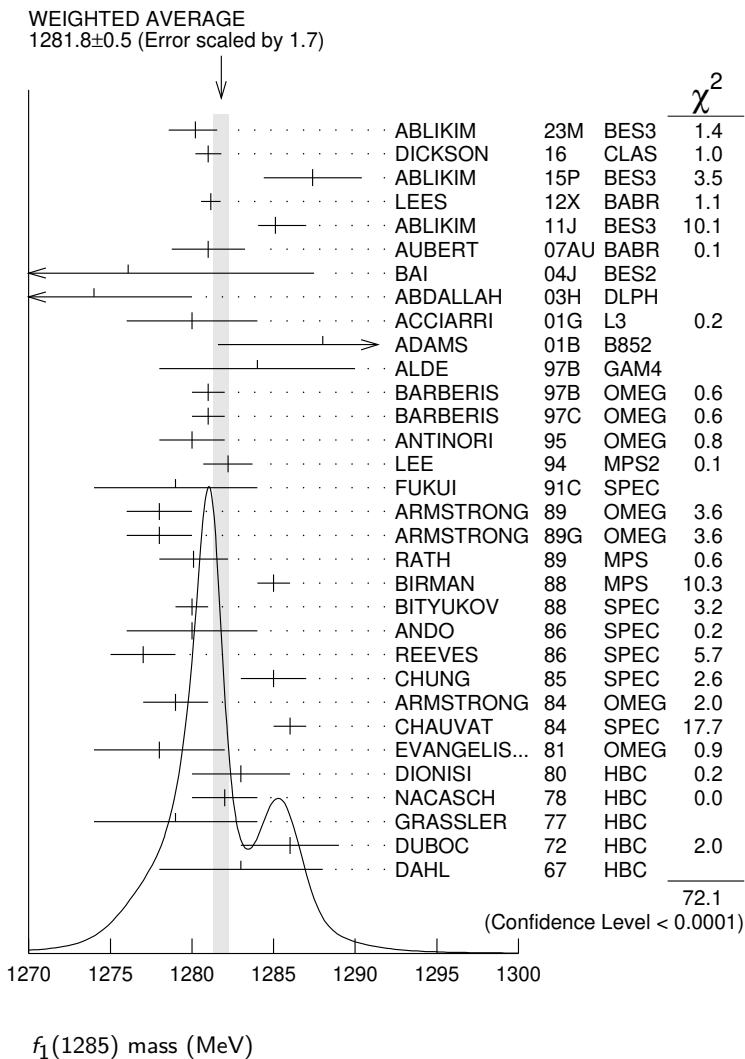
⁵ No systematic error given.

⁶ From a unitarized quark-model calculation.

⁷ From phase shift analysis of $\eta\pi^+ \pi^-$ system.

⁸ Seen in the missing mass spectrum.

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$f_1(1285)$ mass (MeV)

$f_1(1285)$ WIDTH

NODE=M008W

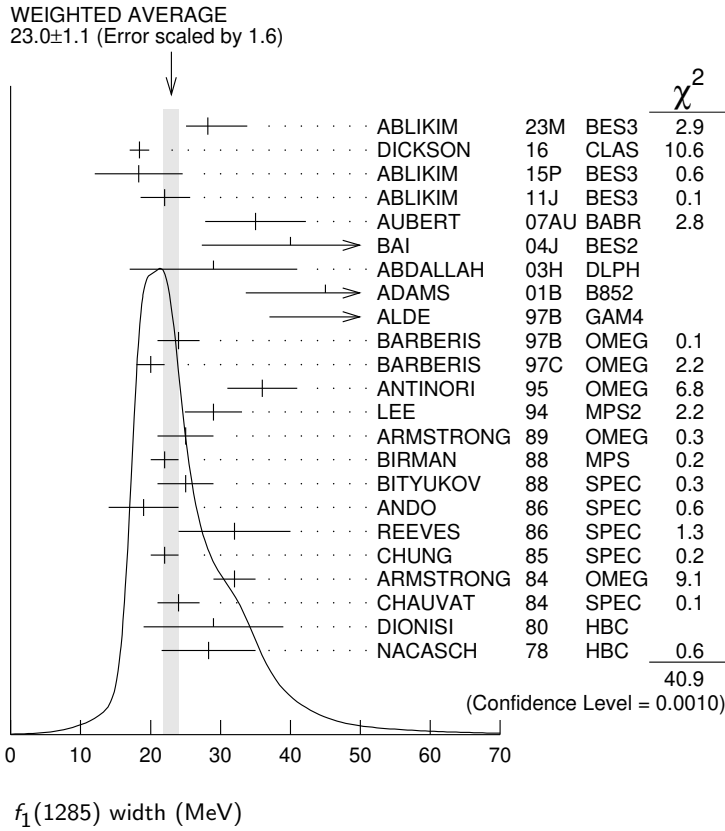
Only experiments giving width error less than 20 MeV are kept for averaging.

NODE=M008W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
23.0± 1.1 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
28.2± 1.1 ^{+5.5} / _{-2.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
18.4± 1.4		DICKSON	16 CLAS	2.55 $\gamma p \rightarrow \eta \pi^+ \pi^- p$
18.3± 6.3	87	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
22.0± 3.1 ^{+2.0} / _{-1.5}		¹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
35 ± 6 ± 4		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
40.0± 8.6± 9.3	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
29 ± 12	237	ABDALLAH	03H DLPH	91.2 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
45 ± 9 ± 7	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
55 ± 18	1400	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
24 ± 3		BARBERIS	97B OMEG	450 $pp \rightarrow pp 2(\pi^+ \pi^-)$
20 ± 2		BARBERIS	97C OMEG	450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
36 ± 5		² ANTINORI	95 OMEG	300,450 $pp \rightarrow pp 2(\pi^+ \pi^-)$
29.0± 4.1		LEE	94 MPS2	18 $\pi^- p \rightarrow K^+ \bar{K}^0 2\pi^- p$
25 ± 4	140	ARMSTRONG	89 OMEG	300 $pp \rightarrow K \bar{K} \pi pp$
22 ± 2	4750	³ BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
25 ± 4	504	BITYUKOV	88 SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$

NODE=M008W

19 ± 5		ANDO	86	SPEC	$8 \pi^- p \rightarrow \eta \pi^+ \pi^- n$	
32 ± 8	420	REEVES	86	SPEC	$6.6 p \bar{p} \rightarrow K K \pi X$	
22 ± 2		CHUNG	85	SPEC	$8 \pi^- p \rightarrow N K \bar{K} \pi$	
32 ± 3	604	ARMSTRONG	84	OMEG	$85 \pi^+ p \rightarrow K \bar{K} \pi \pi p,$ $p p \rightarrow K \bar{K} \pi p p$	
24 ± 3		CHAUVAT	84	SPEC	ISR 31.5 $p p$	
29 ± 10	103	DIONISI	80	HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$	
28.3 ± 6.7	320	NACASCH	78	HBC	$0.7, 0.76 \bar{p} p \rightarrow K \bar{K} 3\pi$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
17.1 ± 3.4	234	ABLIKIM	19BA	BES3	$e^+ e^- \rightarrow \psi(2S)$	
32.4 ± 5.8		⁴ AAIJ	14Y	LHCB	$\bar{B}_{(s)}^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$	
18.2 ± 1.2		⁴ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$	
19.4 ± 1.5		⁴ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+)$	OCCUR=2
40 ± 5		ABATZIS	94	OMEG	$450 p p \rightarrow p p 2(\pi^+ \pi^-)$	
31 ± 5		ARMSTRONG	89E	OMEG	$300 p p \rightarrow p p 2(\pi^+ \pi^-)$	
41 ± 12		ARMSTRONG	89G	OMEG	$85 \pi^+ p \rightarrow 4\pi \pi p, p p \rightarrow$ $4\pi p p$	
17.9 ± 10.9	60	RATH	89	MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$	
14 ⁺²⁰ ₋₁₄ ± 10	16	BECKER	87	MRK3	$e^+ e^- \rightarrow \phi K \bar{K} \pi$	
26 ± 12		EVANGELIS...	81	OMEG	$12 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$	
25 ± 15	200	GURTU	79	HBC	$4.2 K^- p \rightarrow n \eta 2\pi$	
~ 10		⁵ STANTON	79	CNTR	$8.5 \pi^- p \rightarrow n 2\gamma 2\pi$	
24 ± 18	210	GRASSLER	77	HBC	$16 \pi^\mp p$	
28 ± 5	150	⁶ DEFOIX	72	HBC	$0.7 \bar{p} p \rightarrow 7\pi$	
46 ± 9	180	⁶ DUBOC	72	HBC	$1.2 \bar{p} p \rightarrow 2K 4\pi$	
37 ± 5	500	⁷ THUN	72	MMS	$13.4 \pi^- p$	
10 ± 10		BOESEBECK	71	HBC	$16.0 \pi p \rightarrow p 5\pi$	
30 ± 15		CAMPBELL	69	DBC	$2.7 \pi^+ d$	
60 ± 15		⁶ LORSTAD	69	HBC	$0.7 \bar{p} p, 4,5\text{-body}$	
35 ± 10		⁶ DAHL	67	HBC	$1.6\text{--}4.2 \pi^- p$	
¹ The selected process is $J/\psi \rightarrow \omega a_0(980) \pi$. ² Supersedes ABATZIS 94, ARMSTRONG 89E. ³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system. ⁴ No systematic error given. ⁵ From phase shift analysis of $\eta \pi^+ \pi^-$ system. ⁶ Resolution is not unfolded. ⁷ Seen in the missing mass spectrum.						
						NODE=M008W;LINKAGE=BL
						NODE=M008W;LINKAGE=B
						NODE=M008W;LINKAGE=A
						NODE=M008W;LINKAGE=N1
						NODE=M008W;LINKAGE=P
						NODE=M008W;LINKAGE=R
						NODE=M008W;LINKAGE=S



$f_1(1285)$ DECAY MODES

NODE=M008215;NODE=M008

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 4π	$(32.7 \pm 1.8) \%$	S=1.2	DESIG=21
Γ_2 $\pi^0 \pi^0 \pi^+ \pi^-$	$(21.8 \pm 1.2) \%$	S=1.2	DESIG=22
Γ_3 $2\pi^+ 2\pi^-$	$(10.9 \pm 0.6) \%$	S=1.2	DESIG=20
Γ_4 $\rho^0 \pi^+ \pi^-$	$(10.9 \pm 0.6) \%$	S=1.2	DESIG=191
Γ_5 $\rho^0 \rho^0$	seen		DESIG=23
Γ_6 $4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	DESIG=7
Γ_7 $\eta \pi^+ \pi^-$	$(35 \pm 15) \%$		DESIG=198
Γ_8 $\eta \pi \pi$	$(52.2 \pm 1.9) \%$	S=1.2	DESIG=3
Γ_9 $a_0(980) \pi$ [ignoring $a_0(980) \rightarrow K \bar{K}$]	$(38 \pm 4) \%$		DESIG=4
Γ_{10} $\eta \pi \pi$ [excluding $a_0(980) \pi$]	$(14 \pm 4) \%$		DESIG=5
Γ_{11} $K \bar{K} \pi$	$(9.0 \pm 0.4) \%$	S=1.1	DESIG=1
Γ_{12} $K \bar{K}^*(892)$	not seen		DESIG=6
Γ_{13} $\pi^+ \pi^- \pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$		DESIG=197
Γ_{14} $\rho^\pm \pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%	DESIG=199
Γ_{15} $\gamma \rho^0$	$(6.1 \pm 1.0) \%$	S=1.7	DESIG=13
Γ_{16} $\phi \gamma$	$(7.4 \pm 2.6) \times 10^{-4}$		DESIG=10
Γ_{17} $e^+ e^-$	$< 9.4 \times 10^{-9}$	CL=90%	DESIG=200
Γ_{18} $\gamma \gamma^*$			DESIG=9
Γ_{19} $\gamma \gamma$			DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 18 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 24.0$ for 14 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_9	-29			
x_{10}	-12	-89		
x_{11}	22	-9	-4	
x_{15}	-24	-8	-3	-27
	x_1	x_9	x_{10}	x_{11}

$f_1(1285) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M008217

$$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$$

$$\Gamma_8 \Gamma_{19} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{19} / \Gamma$$
NODE=M008G2
NODE=M008G2

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

$$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$$

$$\Gamma_8 \Gamma_{18} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{18} / \Gamma$$
NODE=M008G3
NODE=M008G3

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.4 ± 0.4 OUR AVERAGE				Error includes scale factor of 1.4.
1.18 ± 0.25 ± 0.20	26	^{1,2} AIHARA	88B	TPC $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
2.30 ± 0.61 ± 0.42		^{1,3} GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.8 ± 0.3 ± 0.3	420	⁴ ACHARD	02B	L3 $183-209 e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
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¹ Assuming a ρ -pole form factor.

² Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.

³ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.

⁴ Published value multiplied by the $\eta\pi\pi$ branching ratio 0.52.

NODE=M008G3;LINKAGE=A
NODE=M008G3;LINKAGE=F
NODE=M008G3;LINKAGE=B
NODE=M008G3;LINKAGE=AC

$f_1(1285) \text{ BRANCHING RATIOS}$

NODE=M008220

$$\Gamma(K\bar{K}\pi) / \Gamma(4\pi)$$

$$\Gamma_{11} / \Gamma_1$$
NODE=M008R1
NODE=M008R1

VALUE	DOCUMENT ID	TECN	COMMENT
0.274 ± 0.017 OUR FIT			Error includes scale factor of 1.4.
0.271 ± 0.016 OUR AVERAGE			Error includes scale factor of 1.2.
0.265 ± 0.014	¹ BARBERIS	97C	OMEG 450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
0.28 ± 0.05	² ARMSTRONG	89E	OMEG 300 $pp \rightarrow pp f_1(1285)$
0.37 ± 0.03 ± 0.05	³ ARMSTRONG	89G	OMEG 85 $\pi p \rightarrow 4\pi X$

¹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.

² Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.

³ 4π consistent with being entirely $\rho\pi\pi$.

NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A
$$\Gamma(\pi^0 \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$$

$$\Gamma_2 / \Gamma = \frac{2}{3} \Gamma_1 / \Gamma$$
NODE=M008R18
NODE=M008R18

VALUE	DOCUMENT ID
0.218 ± 0.012 OUR FIT	Error includes scale factor of 1.2.

$$\Gamma(2\pi^+ 2\pi^-) / \Gamma_{\text{total}}$$

$$\Gamma_3 / \Gamma = \frac{1}{3} \Gamma_1 / \Gamma$$
NODE=M008R17
NODE=M008R17

VALUE	DOCUMENT ID
0.109 ± 0.006 OUR FIT	Error includes scale factor of 1.2.

$$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$$

$$\Gamma_4 / \Gamma = \frac{1}{3} \Gamma_1 / \Gamma$$
NODE=M008R19
NODE=M008R19

VALUE	DOCUMENT ID
0.109 ± 0.006 OUR FIT	Error includes scale factor of 1.2.

$$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma(2\pi^+ 2\pi^-)$$

$$\Gamma_4 / \Gamma_3$$
NODE=M008R6
NODE=M008R6

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.4	GRASSLER	77	HBC 16 GeV $\pi^\pm p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

COMMENT

NODE=M008R21
NODE=M008R21

seen

BARBERIS 00C 450 $p\bar{p} \rightarrow p_f 4\pi p_S$ $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

NODE=M008R8
NODE=M008R8

<7

90

ALDE

87

GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$ $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma(\eta \pi^+ \pi^-)$ Γ_{13}/Γ_7

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M008R02
NODE=M008R02**0.86 ± 0.16 ± 0.20**

2.3k

¹ DOROFEEV 11 VES $\pi^- N \rightarrow \pi^- f_1(1285) N$ ¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+ \pi^-$ mass spectrum.

NODE=M008R02;LINKAGE=DO

 $\Gamma(\eta \pi \pi)/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma = (\Gamma_9 + \Gamma_{10})/\Gamma$

VALUE

DOCUMENT ID

NODE=M008R22
NODE=M008R22**0.522 ± 0.019 OUR FIT** Error includes scale factor of 1.2. $\Gamma(4\pi)/\Gamma(\eta \pi \pi)$ $\Gamma_1/\Gamma_8 = \Gamma_1/(\Gamma_9 + \Gamma_{10})$

VALUE

DOCUMENT ID

TECN

COMMENT

NODE=M008R4
NODE=M008R4**0.63 ± 0.06 OUR FIT** Error includes scale factor of 1.2.**0.41 ± 0.14 OUR AVERAGE**

0.37 ± 0.11 ± 0.11

BOLTON

92

MRK3 $J/\psi \rightarrow \gamma f_1(1285)$

0.64 ± 0.40

GURTU

79

HBC 4.2 $K^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.93 ± 0.30

¹ GRASSLER 77 HBC 16 $\pi^\mp p$ ¹ Assuming $\rho \pi \pi$ and $a_0(980)\pi$ intermediate states.

NODE=M008R4;LINKAGE=M

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\eta \pi \pi)$ Γ_3/Γ_8

VALUE

DOCUMENT ID

TECN

COMMENT

NODE=M008R04
NODE=M008R04**0.28 ± 0.02 ± 0.02**¹ LEES 12X BABR $\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$ ¹ Assuming $B(f_1(1285) \rightarrow \pi \pi \eta) = 3/2 B(f_1(1285) \rightarrow \pi^+ \pi^- \eta)$.

NODE=M008R04;LINKAGE=LE

 $\Gamma(a_0(980)\pi [\text{ignoring } a_0(980) \rightarrow K\bar{K}])/ \Gamma(\eta \pi \pi)$ $\Gamma_9/\Gamma_8 = \Gamma_9/(\Gamma_9 + \Gamma_{10})$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

NODE=M008R3
NODE=M008R3**0.72 ± 0.08 OUR FIT****0.72 ± 0.07 OUR AVERAGE**

0.74 ± 0.02 ± 0.09

DICKSON

16

CLAS $\gamma p \rightarrow f_1(1285) p$

0.72 ± 0.15

GURTU

79

HBC 4.2 $K^- p$ 0.6 ^{+0.3}_{-0.2}

CORDEN

78

OMEG 12-15 $\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.69

95

ACHARD

02B

L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

0.28 ± 0.07

ALDE

97B

GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$

1.0 ± 0.3

GRASSLER

77

HBC 16 $\pi^\mp p$ $\Gamma(K\bar{K}\pi)/\Gamma(\eta \pi \pi)$ $\Gamma_{11}/\Gamma_8 = \Gamma_{11}/(\Gamma_9 + \Gamma_{10})$

VALUE

DOCUMENT ID

TECN

COMMENT

NODE=M008R2
NODE=M008R2**0.172 ± 0.011 OUR FIT****0.176 ± 0.012 OUR AVERAGE**

0.216 ± 0.010 ± 0.031

DICKSON

16

CLAS $\gamma p \rightarrow f_1(1285) p$

OCCUR=2

0.166 ± 0.01 ± 0.008

BARBERIS

98C

OMEG 450 $p\bar{p} \rightarrow p_f f_1(1285) p_S$

0.42 ± 0.15

GURTU

79

HBC 4.2 $K^- p$

0.5 ± 0.2

¹ CORDEN

78

OMEG 12-15 $\pi^- p$

0.20 ± 0.08

² DEFOIX

72

HBC 0.7 $\bar{p} p \rightarrow 7\pi$

0.16 ± 0.08

CAMPBELL

69

DBC 2.7 $\pi^+ d$ ¹ CORDEN 78 assumes low-mass $\eta \pi \pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

NODE=M008R2;LINKAGE=CD

² $K\bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).

NODE=M008R2;LINKAGE=K

 $\Gamma(K\bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

NODE=M008R5
NODE=M008R5

not seen

NACASCH

78

HBC

0.7, 0.76 $\bar{p} p \rightarrow K\bar{K} 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen

¹ ACHARD

07

L3

183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$ ¹ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .

NODE=M008R5;LINKAGE=CH

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{13}/Γ

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
0.30±0.055±0.074	2.3k	¹ DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R01
NODE=M008R01

¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+\pi^-$ mass spectrum. The systematic error includes the uncertainty on the partial width $f_1 \rightarrow \eta\pi\pi$ obtained from PDG 10 data.

NODE=M008R01;LINKAGE=DO

$\Gamma(\rho^\pm\pi^\mp)/\Gamma_{total}$ Γ_{14}/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	95	DOROFEEV 11	VES	$\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R03
NODE=M008R03

$\Gamma(\gamma\rho^0)/\Gamma_{total}$ Γ_{15}/Γ

VALUE (units 10 ⁻²)	CL%	DOCUMENT ID	TECN	COMMENT
6.1±1.0 OUR FIT				Error includes scale factor of 1.7.

NODE=M008R15
NODE=M008R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.8±0.7±0.6		¹ AMELIN 95	VES	37 $\pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
<5	95	BITYUKOV 91B	SPEC	32 $\pi^- \rho \rightarrow \pi^+ \pi^- \gamma n$

¹ Not an independent measurement.

NODE=M008R15;LINKAGE=A

$\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$ $\Gamma_{15}/\Gamma_3 = \Gamma_{15}/\frac{1}{3}\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
0.55±0.10 OUR FIT			Error includes scale factor of 1.5.
0.45±0.18	¹ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M008R13
NODE=M008R13

¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0)=0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma 2\pi^+ 2\pi^-)=0.55 \times 10^{-4}$ given by MIR 88.

NODE=M008R13;LINKAGE=E

$\Gamma(\eta\pi\pi)/\Gamma(\gamma\rho^0)$ $\Gamma_8/\Gamma_{15} = (\Gamma_9+\Gamma_{10})/\Gamma_{15}$

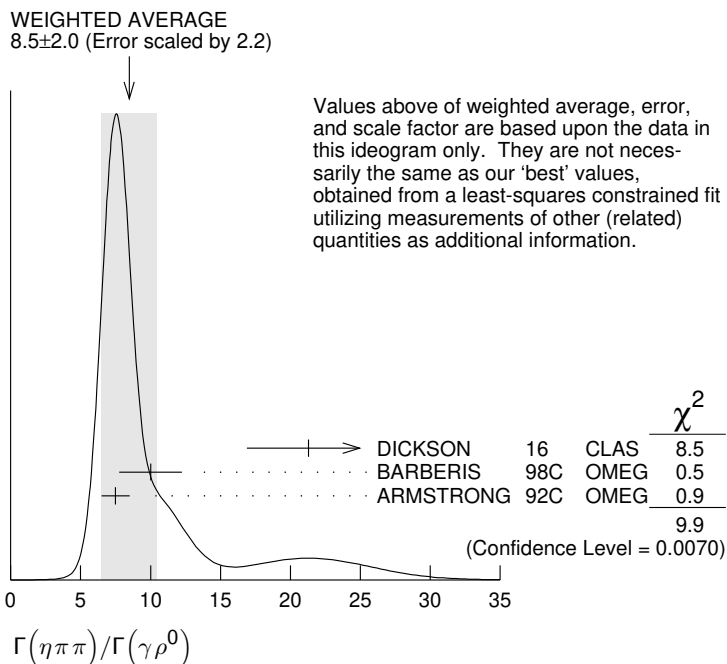
VALUE	DOCUMENT ID	TECN	COMMENT
8.6±1.6 OUR FIT			Error includes scale factor of 1.9.
8.5±2.0 OUR AVERAGE			Error includes scale factor of 2.2. See the ideogram below.

NODE=M008R16
NODE=M008R16

21.3±4.4	DICKSON 16	CLAS	$\gamma\rho \rightarrow f_1(1285)\rho$
10.0±1.0±2.0	BARBERIS 98C	OMEG 450	$\rho\rho \rightarrow \rho_f f_1(1285)\rho_S$
7.5±1.0	¹ ARMSTRONG 92C	OMEG 300	$\rho\rho \rightarrow \rho\rho\pi^+\pi^-\gamma, \rho\rho\eta\pi^+\pi^-$

¹ Published value multiplied by 1.5.

NODE=M008R16;LINKAGE=B



$\Gamma(\gamma\rho^0)/\Gamma(K\bar{K}\pi)$ Γ_{15}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
>0.035	90	¹ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M008R12
NODE=M008R12

¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0)=0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi)<0.72 \times 10^{-3}$.

NODE=M008R12;LINKAGE=F

$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.21 \pm 0.20$		19	BITYUKOV	88	SPEC $32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.50	95		BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285) p_S$
<0.93	95		AMELIN	95	VES $37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.4 \times 10^{-9}$	90	1 ACHASOV	20	SND $e^+e^- \rightarrow \eta\pi^0\pi^0$

¹ACHASOV 20 reports two candidate events corresponding to a significance of 2.5σ and the branching fraction of $(5.1^{+3.7}_{-2.7}) \times 10^{-9}$.

 $f_1(1285)$ REFERENCES

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
ACHASOV	20	PL B800 135074	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60144
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
DICKSON	16	PR C93 065202	R. Dickson <i>et al.</i>	(JLab CLAS Collab.)	REFID=57487
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
AAIJ	14Y	PRL 112 091802	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55837
LEES	12X	PR D86 092010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54714
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53931
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)	REFID=16755
PDG	10	JP G37 075021	K. Nakamura <i>et al.</i>	(PDG Collab.)	REFID=53229
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
BARBERIS	97B	Translated from YAF 60 458	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BARBERIS	97C	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
AMELIN	95	ZPHY C66 71	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=44376
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44437
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44090
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)	REFID=44092
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BITYUKOV	91B	SJNP 54 318	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=41864
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)	REFID=40729
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
BITYUKOV	88	PL B203 327	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=40569
MIR	88	Photon-Photon 88, 126	R. Mir	(Mark III Collab.)	REFID=41574
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=20929
BITYUKOV	84B	PL 144B 133	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=20468
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HEL5)	REFID=20573
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)	REFID=20922
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+)	REFID=20924
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)	REFID=20456
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP	REFID=20887
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20452
NACASCH	78	NP B135 203	R. Nacasch <i>et al.</i>	(PARIS, MADR, CERN)	REFID=20919
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20447
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DUBOC	72	NP B46 429	J. Duboc <i>et al.</i>	(PARIS, LIVP)	REFID=20339
THUN	72	PRL 28 1733	R. Thun <i>et al.</i>	(STON, NEAS)	REFID=20911
BARDADIN...	71	PR D4 2711	M. Bardadin-Otwinowska <i>et al.</i>	(WARS)	REFID=20196
BOESEBECK	71	PL 34B 659	K. Boesebeck	(AACH, BERL, BONN, CERN, CRAC+)	REFID=20905
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)	REFID=20419
LORSTAD	69	NP B14 63	B. Lorstad <i>et al.</i>	(CDEF, CERN) JP	REFID=20901
D'ANDLAU	68	NP B5 693	C. d'Andlau <i>et al.</i>	(CDEF, CERN, IRAD+) IJP	REFID=20897
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321

NODE=M008R9
NODE=M008R9

NODE=M008R00
NODE=M008R00

OCCUR=2

NODE=M008R00;LINKAGE=B

NODE=M008

$\eta(1295)$

$$I^G(J^{PC}) = 0^+(0^{-+})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M037

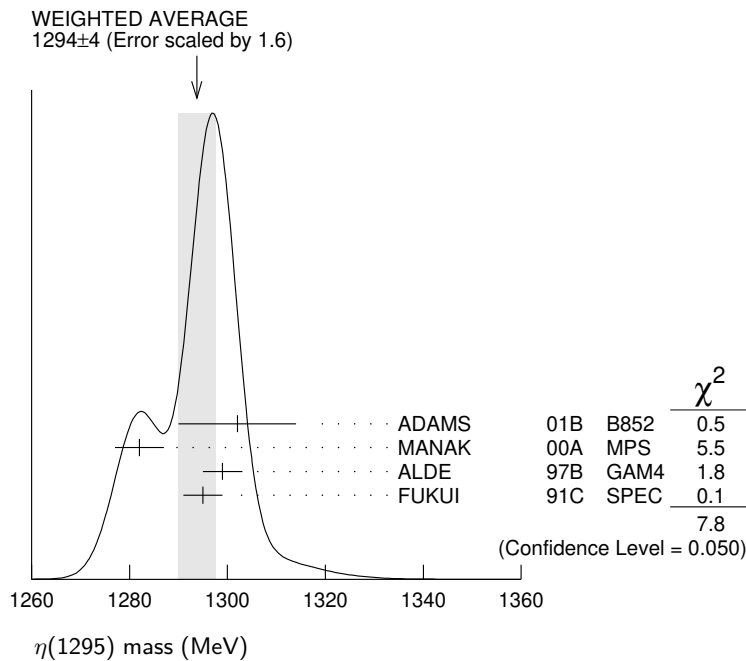
NODE=M037

NODE=M037M

NODE=M037M

 $\eta(1295)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1294±4 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
1302±9±8	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1282±5	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1299±4	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1295±4		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1264±8		¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 1275		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$



¹ PWA analysis of AUGUSTIN 92 assigns 0^{-+} quantum numbers to this state rather than 1^{++} as before.

NODE=M037M;LINKAGE=AG

 $\eta(1295)$ WIDTH

NODE=M037W

NODE=M037W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
55± 5 OUR AVERAGE				
57±23±21	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
66±13	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
53± 6		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<40	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
44±20		¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 70		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$

¹ PWA analysis of AUGUSTIN 92 assigns 0^{-+} quantum numbers to this state rather than 1^{++} as before.

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

NODE=M037215;NODE=M037

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi^+\pi^-$	seen
Γ_2 $a_0(980)\pi$	seen
Γ_3 $\gamma\gamma$	
Γ_4 $\eta\pi^0\pi^0$	seen
Γ_5 $\eta(\pi\pi)S\text{-wave}$	seen
Γ_6 $\sigma\eta$	seen
Γ_7 $K\bar{K}\pi$	seen

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←

 $\eta(1295)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M037220

 $\Gamma(\eta\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_3/\Gamma$ NODE=M037G2
NODE=M037G2

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.066	95	ACCIARRI	01G L3	183-202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$ $e^+e^-\eta\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
<0.3		ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi\pi$

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_3/\Gamma$ NODE=M037G3
NODE=M037G3

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.014	90	1,2 AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$ $e^+e^-K_S^0K^\pm\pi^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\eta(1295)$ mass and width 1294 MeV and 55 MeV, respectively.² Assuming three-body phase-space decay to $K_S^0K^\pm\pi^\mp$.NODE=M037G3;LINKAGE=AH
NODE=M037G3;LINKAGE=B3 $\eta(1295)$ BRANCHING RATIOS

NODE=M037225

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ NODE=M037R1
NODE=M037R1

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	BERTIN	97 OBLX	0.0 $\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp\pi^+\pi^-$
seen	BIRMAN	88 MPS	8 $\pi^-p \rightarrow K^+\bar{K}^0\pi^-n$
large	ANDO	86 SPEC	8 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
large	STANTON	79 CNTR	8.4 $\pi^-p \rightarrow n\eta 2\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi^0\pi^0)$ Γ_2/Γ_4 NODE=M037R2
NODE=M037R2

VALUE	DOCUMENT ID	TECN	COMMENT
0.65 ± 0.10	¹ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

¹ Assuming that $a_0(980)$ decays only to $\eta\pi$.

NODE=M037R2;LINKAGE=A

 $\Gamma(\eta(\pi\pi)S\text{-wave})/\Gamma(\eta\pi^0\pi^0)$ Γ_5/Γ_4 NODE=M037R4
NODE=M037R4

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ± 0.10	ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

 $\Gamma(a_0(980)\pi)/\Gamma(\sigma\eta)$ Γ_2/Γ_6 NODE=M037R5
NODE=M037R5

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.22	9082	MANAK	00A MPS	18 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

 $\eta(1295)$ REFERENCES

NODE=M037

AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 60 458.		
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP

REFID=50764
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REFID=47989
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REFID=45417
REFID=41584
REFID=41748
REFID=41352
REFID=40564
REFID=40568
REFID=40008
REFID=20891
REFID=20887

$\pi(1300)$

$$I^G(J^{PC}) = 1^-(0^-+)$$

NODE=M058

 $\pi(1300)$ MASS

NODE=M058M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1300±100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1128± 26±70		DARGENT 17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1345± 8±10	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
1200± 40	90k	SALVINI 04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1343± 15±24		CHUNG 02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1375± 40		ABELE 01	CBAR	$0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
1275± 15		BERTIN 97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+ 2\pi^-$
~ 1114		ABELE 96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
1190± 30		ZIELINSKI 84	SPEC	$200 \pi^+ Z \rightarrow Z 3\pi$
1240± 30		BELLINI 82	SPEC	$40 \pi^- A \rightarrow A 3\pi$
1273± 50		² AARON 81	RVUE	
1342± 20		BONESINI 81	OMEG	$12 \pi^- p \rightarrow p 3\pi$
~ 1400		DAUM 81B	SPEC	$63,94 \pi^- p$

NODE=M058M

→ UNCHECKED ←

¹ From analysis of L3 data at 183–209 GeV.² Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.NODE=M058M;LINKAGE=SC
NODE=M058M;LINKAGE=E $\pi(1300)$ WIDTH

NODE=M058W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
200 to 600 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
314± 39±66		DARGENT 17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
260± 20±30	18k	³ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
470±120	90k	SALVINI 04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
449± 39±47		CHUNG 02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
268± 50		ABELE 01	CBAR	$0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
218±100		BERTIN 97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+ 2\pi^-$
~ 340		ABELE 96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
440± 80		ZIELINSKI 84	SPEC	$200 \pi^+ Z \rightarrow Z 3\pi$
360±120		BELLINI 82	SPEC	$40 \pi^- A \rightarrow A 3\pi$
580±100		⁴ AARON 81	RVUE	
220± 70		BONESINI 81	OMEG	$12 \pi^- p \rightarrow p 3\pi$
~ 600		DAUM 81B	SPEC	$63,94 \pi^- p$

NODE=M058W

→ UNCHECKED ←

³ From analysis of L3 data at 183–209 GeV.⁴ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.NODE=M058W;LINKAGE=SC
NODE=M058W;LINKAGE=E $\pi(1300)$ DECAY MODES

NODE=M058215;NODE=M058

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\pi(\pi\pi)S$ -wave	seen
Γ_3 $\gamma\gamma$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

 $\pi(1300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M058218

$\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_3/\Gamma$
<0.085	90	ACCIARRI 97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.8	95	⁵ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	
<0.54	90	ALBRECHT 97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	

⁵ From analysis of L3 data at 183–209 GeV.

NODE=M058G1

NODE=M058G1

NODE=M058G1;LINKAGE=SC

$\pi(1300)$ BRANCHING RATIOS $\Gamma(\pi\pi)_{S\text{-wave}}/\Gamma(\rho\pi)$ Γ_2/Γ_1

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.4		90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
seen			CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ 2\pi^- p$
<0.15	90		ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
2.12			⁶ AARON	81	RVUE

⁶ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058220

NODE=M058R1
NODE=M058R1

NODE=M058R1;LINKAGE=E

 $\pi(1300)$ REFERENCES

DARGENT	17	JHEP 1705 143	P. dArgent <i>et al.</i>	(HEID, BRIS)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	97T	PL B413 147	M. Acciari <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ZIELINSKI	84	PR D30 1855	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
AARON	81	PR D24 1207	R.A. Aaron, R.S. Longacre	(NEAS, BNL)
BONESINI	81	PL 103B 75	M. Bonesini <i>et al.</i>	(MILA, LIVP, DARE+)
DANKOWY...	81	PRL 46 580	J.A. Dankowych <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M058

REFID=58121
REFID=51186
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REFID=48837
REFID=48334
REFID=45761
REFID=45418
REFID=45763
REFID=45011
REFID=20881
REFID=21134
REFID=20870
REFID=21130
REFID=20572
REFID=20872
REFID=20868
REFID=20571

NODE=M012

 $a_2(1320)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

 $a_2(1320)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1305–1321)–i(52–58) OUR ESTIMATE			
(1318.7 ± 1.9 ± 1.3)–i(53.8 ± 2.3 ^{+1.7} _{-0.9})	¹ KOPF	21	RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$, $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$
(1312.5 ± 0.7 ± 2.6)–i(53.5 ± 0.6 ± 1.9)	² ALBRECHT	20	RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$, $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$
(1306.0 ± 0.8 ± 1.3)–i(57.2 ± 0.8 ± 0.0)	³ RODAS	19	RVUE 91 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
(1309 ± 4) – i (55 ± 2)	⁴ ANISOVICH	09	RVUE $\bar{p}p$, πN

¹ Extraction based on a combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\bar{K}$ systems.

² T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\bar{K}$).

³ Coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data. Supersedes JACKURA 18. Performed by JPAC.

⁴ Amplitude did not include dispersive corrections. From analysis of $\eta\pi$ mode.

NODE=M012PP

NODE=M012PP

NODE=M012PP

→ UNCHECKED ←

NODE=M012PP;LINKAGE=B

NODE=M012PP;LINKAGE=C

NODE=M012PP;LINKAGE=D

NODE=M012PP;LINKAGE=A

 $a_2(1320)$ MASS

VALUE (MeV)	DOCUMENT ID
1318.2 ± 0.6 OUR AVERAGE	Includes data from the 4 datablocks that follow this one. Error includes scale factor of 1.2.

NODE=M012M0

NODE=M012M0

3π MODE

NODE=M012M1
NODE=M012M1

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

1318.6 ± 1.3 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1314.5 ^{+4.0} _{-3.3}	46M	¹ AGHASYAN	18B	COMP	190 π ⁻ p → π ⁻ π ⁺ π ⁻ p
1326 ± 2 ± 2		CHUNG	02	B852	18.3 π ⁻ p → π ⁺ π ⁻ π ⁻ p
1317 ± 3		BARBERIS	98B		450 p p → p _f π ⁺ π ⁻ π ⁰ p _s
1323 ± 4 ± 3		ACCIARRI	97T	L3	e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻ π ⁰
1320 ± 7		ALBRECHT	97B	ARG	e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻ π ⁰
1311.3 ± 1.6 ± 3.0	72.4k	AMELIN	96	VES	36 π ⁻ p → π ⁺ π ⁻ π ⁰ n
1310 ± 5		ARMSTRONG	90	OMEG 0	300.0 p p → p p π ⁺ π ⁻ π ⁰
1323.8 ± 2.3	4022	AUGUSTIN	89	DM2 ±	J/ψ → ρ [±] a ₂ [∓]
1320.6 ± 3.1	3562	AUGUSTIN	89	DM2 0	J/ψ → ρ ⁰ a ₂ ⁰
1317 ± 2	25k	² DAUM	80C	SPEC -	63,94 π ⁻ p → 3π p
1320 ± 10	1097	² BALTAY	78B	HBC +0	15 π ⁺ p → p 4π
1306 ± 8		FERRERSORIA	78	OMEG -	9 π ⁻ p → p 3π
1318 ± 7	1.6k	² EMMS	75	DBC 0	4 π ⁺ n → p (3π) ⁰
1315 ± 5		² ANTIPOV	73C	CNTR -	25,40 π ⁻ p → ρ η π ⁻
1306 ± 9	1580	CHALOUKKA	73	HBC -	3.9 π ⁻ p

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1321 ± 1 ⁺⁰ ₋₇	420k	³ ALEKSEEV	10	COMP	190 π ⁻ P b → π ⁻ π ⁻ π ⁺ P b'
1300 ± 2 ± 4	18k	⁴ SCHEGELSKY	06	RVUE 0	γγ → π ⁺ π ⁻ π ⁰
1305 ± 14		CONDO	93	SHF	γγ → n π ⁺ π ⁺ π ⁻
1310 ± 2		² EVANGELIS...	81	OMEG -	12 π ⁻ p → 3π p
1343 ± 11	490	BALTAY	78B	HBC 0	15 π ⁺ p → Δ 3π
1309 ± 5	5k	BINNIE	71	MMS -	π ⁻ p near a ₂ thresh- old
1299 ± 6	28k	BOWEN	71	MMS -	5 π ⁻ p
1300 ± 6	24k	BOWEN	71	MMS +	5 π ⁺ p
1309 ± 4	17k	BOWEN	71	MMS -	7 π ⁻ p
1306 ± 4	941	ALSTON-...	70	HBC +	7.0 π ⁺ p → 3π p

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

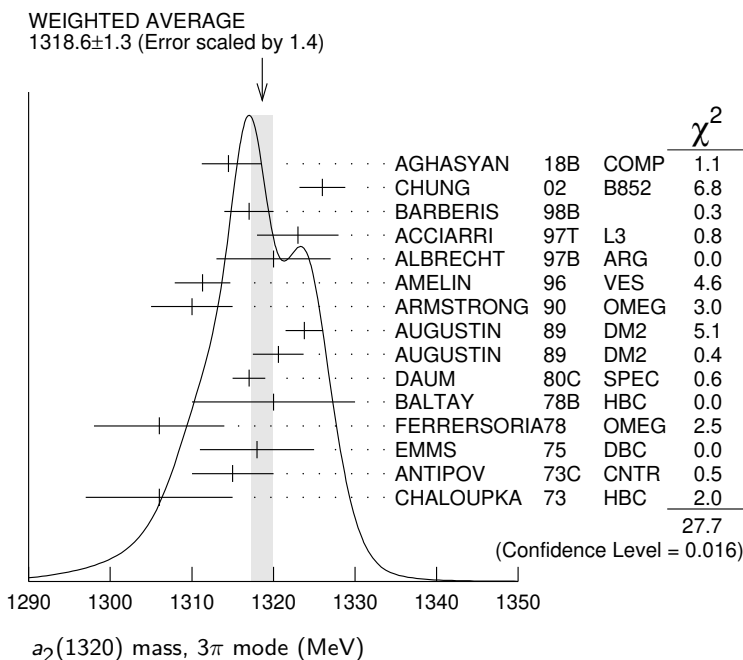
¹ Statistical error negligible.

² From a fit to J^P = 2⁺ ρ π partial wave.

³ Superseded by AGHASYAN 2018B.

⁴ From analysis of L3 data at 183–209 GeV.

NODE=M012M1;LINKAGE=D
NODE=M012M1;LINKAGE=P
NODE=M012M1;LINKAGE=C
NODE=M012M1;LINKAGE=SC



$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M012M2
NODE=M012M2**1318.1± 0.7 OUR AVERAGE**

1319 ± 5	4700	^{1,2} CLELAND	82B	SPEC	+	50 $\pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
1324 ± 6	5200	^{1,2} CLELAND	82B	SPEC	-	50 $\pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
1320 ± 2	4000	CHABAUD	80	SPEC	-	17 $\pi^- A \rightarrow K_S^0 K^- A$	
1312 ± 4	11000	CHABAUD	78	SPEC	-	9.8 $\pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
1316 ± 2	4730	CHABAUD	78	SPEC	-	18.8 $\pi^- p \rightarrow K^- K_S^0 p$	
1318 ± 1		^{1,3} MARTIN	78D	SPEC	-	10 $\pi^- p \rightarrow K_S^0 K^- p$	
1320 ± 2	2724	MARGULIE	76	SPEC	-	23 $\pi^- p \rightarrow K^- K_S^0 p$	
1313 ± 4	730	FOLEY	72	CNTR	-	20.3 $\pi^- p \rightarrow K^- K_S^0 p$	
1319 ± 3	1500	³ GRAYER	71	ASPK	-	17.2 $\pi^- p \rightarrow K^- K_S^0 p$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

1304 ± 10	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
1330 ± 11	1000	^{1,2} CLELAND	82B	SPEC	+	30 $\pi^+ p \rightarrow K_S^0 K^+ p$	
1324 ± 5	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$	

¹ From a fit to $J^P = 2^+$ partial wave.² Number of events evaluated by us.³ Systematic error in mass scale subtracted.⁴ From analysis of L3 data at 91 and 183–209 GeV.NODE=M012M2;LINKAGE=P
NODE=M012M2;LINKAGE=W
NODE=M012M2;LINKAGE=S
NODE=M012M2;LINKAGE=SC **$\eta\pi$ MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M012M3
NODE=M012M3**1317.7± 1.4 OUR AVERAGE**

1308 ± 9		BARBERIS	00H			450 $p p \rightarrow p_f \eta \pi^0 p_s$	
1316 ± 9		BARBERIS	00H			450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$	OCCUR=2
1317 ± 1 ± 2		THOMPSON	97	MPS		18 $\pi^- p \rightarrow \eta \pi^- p$	
1315 ± 5 ± 2		¹ AMSLER	94D	CBAR		0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$	
1325.1 ± 5.1		AOYAGI	93	BKEI		$\pi^- p \rightarrow \eta \pi^- p$	
1317.7 ± 1.4 ± 2.0		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta \pi^- N$	
1323 ± 8	1000	² KEY	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	
1307 ± 1 ± 6		³ JACKURA	18	RVUE		$\pi^- p \rightarrow \eta \pi^- p$	
1315 ± 12		⁴ ADOLPH	15	COMP		191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$	
1324 ± 5		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
1336.2 ± 1.7	2561	DELFOSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$	OCCUR=2
1330.7 ± 2.4	1653	DELFOSE	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$	
1324 ± 8	6200	^{2,5} CONFORTO	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	

¹ The systematic error of 2 MeV corresponds to the spread of solutions.² Error includes 5 MeV systematic mass-scale error.³ Superseded by RODAS 19.⁴ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.⁵ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.NODE=M012M3;LINKAGE=DD
NODE=M012M3;LINKAGE=E
NODE=M012M3;LINKAGE=B
NODE=M012M3;LINKAGE=A
NODE=M012M3;LINKAGE=M **$\eta'\pi$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M012M4
NODE=M012M4**1322 ± 7 OUR AVERAGE**

1318 ± 8 $^{+3}_{-5}$		IVANOV	01	B852		18 $\pi^- p \rightarrow \eta' \pi^- p$	
1327.0 ± 10.7		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta' \pi^- N$	

 $a_2(1320)$ WIDTH

NODE=M012W

VALUE (MeV)	DOCUMENT ID
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107 ± 5 OUR ESTIMATENODE=M012W
→ UNCHECKED ←**107.8 ± 1.2 OUR AVERAGE** Includes data from the 4 datablocks that follow this one.

3 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M012W1
 NODE=M012W1

105.0 $^{+1.7}_{-1.9}$ OUR AVERAGE

106.6 $^{+3.4}_{-7.0}$	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$	
108 $\pm 3 \pm 15$		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
120 ± 10		BARBERIS	98B		450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$	
105 $\pm 10 \pm 11$		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	
120 ± 10		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	
103.0 $\pm 6.0 \pm 3.3$	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$	
120 ± 10		ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$	
107.0 ± 9.7	4022	AUGUSTIN	89	DM2 \pm	$J/\psi \rightarrow \rho^\pm a_2^\mp$	
118.5 ± 12.5	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$	OCCUR=2
97 ± 5		² EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow 3\pi p$	
96 ± 9	25k	² DAUM	80C	SPEC -	63,94 $\pi^- p \rightarrow 3\pi p$	
110 ± 15	1097	² BALTAY	78B	HBC +0	15 $\pi^+ p \rightarrow p 4\pi$	
112 ± 18	1.6k	² EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$	
122 ± 14	1.2k	^{2,3} WAGNER	75	HBC 0	7 $\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$	
115 ± 15		² ANTIPOV	73C	CNTR -	25,40 $\pi^- p \rightarrow p \eta \pi^-$	
99 ± 15	1580	CHALOUPKA	73	HBC -	3.9 $\pi^- p$	
105 ± 5	28k	BOWEN	71	MMS -	5 $\pi^- p$	
99 ± 5	24k	BOWEN	71	MMS +	5 $\pi^+ p$	OCCUR=2
103 ± 5	17k	BOWEN	71	MMS -	7 $\pi^- p$	OCCUR=3

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

110 $\pm 2 \pm 15$	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$	
117 $\pm 6 \pm 20$	18k	⁵ SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	
120 ± 40		CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$	
115 ± 14	490	BALTAY	78B	HBC 0	15 $\pi^+ p \rightarrow \Delta 3\pi$	OCCUR=2
72 ± 16	5k	BINNIE	71	MMS -	$\pi^- p$ near a_2 threshold	OCCUR=2
79 ± 12	941	ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$	

¹ Statistical error negligible.² From a fit to $J^P = 2^+ \rho\pi$ partial wave.³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁴ Superseded by AGHASYAN 2018B.⁵ From analysis of L3 data at 183–209 GeV.

NODE=M012W1;LINKAGE=C
 NODE=M012W1;LINKAGE=P
 NODE=M012W1;LINKAGE=S
 NODE=M012W1;LINKAGE=E
 NODE=M012W1;LINKAGE=SC

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M012W2
 NODE=M012W2

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{1,2} CLELAND	82B	SPEC +	50 $\pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
120 ± 25	5200	^{1,2} CLELAND	82B	SPEC -	50 $\pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
106 ± 4	4000	CHABAUD	80	SPEC -	17 $\pi^- A \rightarrow K_S^0 K^- A$	
126 ± 11	11000	CHABAUD	78	SPEC -	9.8 $\pi^- p \rightarrow K^- K_S^0 p$	
101 ± 8	4730	CHABAUD	78	SPEC -	18.8 $\pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
113 ± 4		^{1,3} MARTIN	78D	SPEC -	10 $\pi^- p \rightarrow K_S^0 K^- p$	
105 ± 8	2724	³ MARGULIE	76	SPEC -	23 $\pi^- p \rightarrow K^- K_S^0 p$	
113 ± 19	730	FOLEY	72	CNTR -	20.3 $\pi^- p \rightarrow K^- K_S^0 p$	
123 ± 13	1500	³ GRAYER	71	ASPK -	17.2 $\pi^- p \rightarrow K^- K_S^0 p$	

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

120 ± 15	870	⁴ SCHEGELSKY	06A	RVUE 0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
121 ± 51	1000	^{1,2} CLELAND	82B	SPEC +	30 $\pi^+ p \rightarrow K_S^0 K^+ p$	
110 ± 18	350	HYAMS	78	ASPK +	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$	

- ¹ From a fit to $J^P = 2^+$ partial wave.
² Number of events evaluated by us.
³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
⁴ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P
 NODE=M012W2;LINKAGE=W
 NODE=M012W2;LINKAGE=S
 NODE=M012W2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W3
 NODE=M012W3

111.1± 2.4 OUR AVERAGE

115 ±20		BARBERIS	00H			450 $p\bar{p} \rightarrow p_f \eta \pi^0 p_s$	
112 ±14		BARBERIS	00H			450 $p\bar{p} \rightarrow \Delta_f^{++} \eta \pi^- p_s$	OCCUR=2
112 ± 3 ±2		¹ AMSLER	94D	CBAR		0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$	
103 ± 6 ±3		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta \pi^- N$	
112.2± 5.7	2561	DELFOSSÉ	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$	
116.6± 7.7	1653	DELFOSSÉ	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$	OCCUR=2
108 ± 9	1000	KEY	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

112 ± 1 ±8		² JACKURA	18	RVUE		$\pi^- p \rightarrow \eta \pi^- p$	
119 ±14		³ ADOLPH	15	COMP		191 $\pi^- p \rightarrow \eta^{(l)} \pi^- p$	
127 ± 2 ±2		⁴ THOMPSON	97	MPS		18 $\pi^- p \rightarrow \eta \pi^- p$	
118 ±10		ARMSTRONG	93C	E760	0	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
104 ± 9	6200	⁵ CONFORTO	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$	

¹ The systematic error of 2 MeV corresponds to the spread of solutions.

² Superseded by RODAS 19.

³ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.

⁴ Resolution is not unfolded.

⁵ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD
 NODE=M012W3;LINKAGE=C
 NODE=M012W3;LINKAGE=B

NODE=M012W3;LINKAGE=A
 NODE=M012W3;LINKAGE=M

$\eta'\pi$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W4
 NODE=M012W4

119±25 OUR AVERAGE

140±35±20		IVANOV	01	B852		18 $\pi^- p \rightarrow \eta' \pi^- p$	
106±32		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta' \pi^- N$	

$a_2(1320)$ DECAY MODES

NODE=M012215;NODE=M012

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 3π	(70.1 ±2.7) %	S=1.2
Γ_2 $\rho(770)\pi$		
Γ_3 $f_2(1270)\pi$		
Γ_4 $\rho(1450)\pi$		
Γ_5 $\eta\pi$	(14.5 ±1.2) %	
Γ_6 $\omega\pi\pi$	(10.6 ±3.2) %	S=1.3
Γ_7 $K\bar{K}$	(4.9 ±0.8) %	
Γ_8 $\eta'(958)\pi$	(5.5 ±0.9) × 10 ⁻³	
Γ_9 $\pi^\pm\gamma$	(2.91±0.27) × 10 ⁻³	
Γ_{10} $\gamma\gamma$	(9.4 ±0.7) × 10 ⁻⁶	
Γ_{11} e^+e^-	< 5 × 10 ⁻⁹	CL=90%

DESIG=1
 DESIG=11
 DESIG=12
 DESIG=13
 DESIG=3
 DESIG=4
 DESIG=2
 DESIG=8
 DESIG=7
 DESIG=9
 DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 18 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 9.3$ for 15 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	10		
x_6	-89	-46	
x_7	-1	-2	-24
	x_1	x_5	x_6

$a_2(1320)$ PARTIAL WIDTHS

$\Gamma(\eta\pi)$

Γ_5

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

••• We do not use the following data for averages, fits, limits, etc. •••

18.5 ± 3.0 870 ¹ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012220

NODE=M012W6
NODE=M012W6

NODE=M012W6;LINKAGE=SC

$\Gamma(K\bar{K})$

Γ_7

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

••• We do not use the following data for averages, fits, limits, etc. •••

7.0^{+2.0}_{-1.5} 870 ¹ SCHEGELSKY 06A RVUE 0 $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W5
NODE=M012W5

NODE=M012W5;LINKAGE=SC

$\Gamma(\pi^\pm\gamma)$

Γ_9

VALUE (keV) EVTS DOCUMENT ID TECN CHG COMMENT

311 ± 25 OUR AVERAGE

358 ± 6 ± 42 ¹ ADOLPH 14 COMP - 190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$

284 ± 25 ± 25 7.1k MOLCHANOV 01 SELX 600 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

295 ± 60 CIHANGIR 82 SPEC + 200 $\pi^+ A$

••• We do not use the following data for averages, fits, limits, etc. •••

461 ± 110 ² MAY 77 SPEC ± 9.7 γA

¹ Primakoff reaction using $a_2(1320) \rightarrow 3\pi$ branching ratio of 70.1%.

² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7

NODE=M012W7;LINKAGE=AD
NODE=M012W;LINKAGE=M2

$\Gamma(\gamma\gamma)$

Γ_{10}

VALUE (keV) EVTS DOCUMENT ID TECN CHG COMMENT

1.00 ± 0.06 OUR AVERAGE

0.98 ± 0.05 ± 0.09 ACCIARRI 97T L3 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

0.96 ± 0.03 ± 0.13 ALBRECHT 97B ARG $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

1.26 ± 0.26 ± 0.18 36 BARU 90 MD1 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

1.00 ± 0.07 ± 0.15 415 BEHREND 90C CELL 0 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

1.03 ± 0.13 ± 0.21 BUTLER 90 MRK2 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

1.01 ± 0.14 ± 0.22 85 OEST 90 JADE $e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

0.90 ± 0.27 ± 0.15 56 ¹ ALTHOFF 86 TASS 0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

1.14 ± 0.20 ± 0.26 ² ANTREASYAN 86 CBAL 0 $e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

1.06 ± 0.18 ± 0.19 BERGER 84C PLUT 0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

••• We do not use the following data for averages, fits, limits, etc. •••

0.81 ± 0.19^{+0.42}_{-0.11} 35 ¹ BEHREND 82C CELL 0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

0.77 ± 0.18 ± 0.27 22 ² EDWARDS 82F CBAL 0 $e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

¹ From $\rho\pi$ decay mode.

² From $\eta\pi^0$ decay mode.

NODE=M012W9
NODE=M012W9

NODE=M012W;LINKAGE=F
NODE=M012W;LINKAGE=G

$\Gamma(e^+e^-)$ Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV	00K SND	$e^+e^- \rightarrow \pi^0\pi^0$
••• We do not use the following data for averages, fits, limits, etc. •••				
<25	90	VOROBYEV	88 ND	$e^+e^- \rightarrow \pi^0\eta$

NODE=M012W10
 NODE=M012W10

 $a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M012223

 $\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.65±0.02±0.02	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
¹ From analysis of L3 data at 183–209 GeV.				

NODE=M012G2
 NODE=M012G2

NODE=M012G2;LINKAGE=SC

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.145 ^{+0.097} _{-0.034}	¹ UEHARA 09A	BELL	$e^+e^- \rightarrow e^+e^-\eta\pi^0$
¹ From the D_2 -wave. The fraction of the D_0 -wave is 3.4 ^{+2.3} _{-1.1} %.			

NODE=M012G01
 NODE=M012G01

NODE=M012G01;LINKAGE=UE

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.126±0.007±0.028	¹ ALBRECHT 90G	ARG	$e^+e^- \rightarrow e^+e^-K^+K^-$
••• We do not use the following data for averages, fits, limits, etc. •••			
0.081±0.006±0.027	² ALBRECHT 90G	ARG	$e^+e^- \rightarrow e^+e^-K^+K^-$
¹ Using an incoherent background.			
² Using a coherent background.			

NODE=M012G1
 NODE=M012G1

OCCUR=2

NODE=M012G1;LINKAGE=A
 NODE=M012G1;LINKAGE=B

 $a_2(1320)$ BRANCHING RATIOS

NODE=M012225

 $[\Gamma(f_2(1270)\pi) + \Gamma(\rho(1450)\pi)]/\Gamma(\rho(770)\pi)$ $(\Gamma_3+\Gamma_4)/\Gamma_2$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.12	90	ABRAMOVI...	70B HBC	-	3.93 π^-p

NODE=M012R9
 NODE=M012R9

 $\Gamma(\rho(770)\pi)/\Gamma(f_2(1270)\pi)$ Γ_2/Γ_3

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
16.5 ^{+1.2} _{-2.4}	46M	¹ AGHASYAN 18B	COMP	190 $\pi^-p \rightarrow \pi^-\pi^+\pi^-p$

NODE=M012R00
 NODE=M012R00

¹ Statistical error negligible.

NODE=M012R00;LINKAGE=A

 $\Gamma(\eta\pi)/\Gamma(3\pi)$ Γ_5/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
0.207±0.018		OUR FIT			
0.213±0.020		OUR AVERAGE			
0.18 ±0.05		FORINO 76	HBC		11 π^-p
0.22 ±0.05	52	ANTIPOV 73	CNTR	-	40 π^-p
0.211±0.044	149	CHALOUKKA 73	HBC	-	3.9 π^-p
0.246±0.042	167	ALSTON-... 71	HBC	+	7.0 π^+p
0.25 ±0.09	15	BOECKMANN 70	HBC	+	5.0 π^+p
0.23 ±0.08	22	ASCOLI 68	HBC	-	5 π^-p
0.12 ±0.08		CHUNG 68	HBC	-	3.2 π^-p
0.22 ±0.09		CONTE 67	HBC	-	11.0 π^-p

NODE=M012R3
 NODE=M012R3

 $\Gamma(\omega\pi\pi)/\Gamma(3\pi)$ Γ_6/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
0.15±0.05		OUR FIT Error includes scale factor of 1.3.			
0.15±0.05		OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.			
0.28±0.09	60	DIAZ 74	DBC	0	6 π^+n
0.18±0.08		¹ KARSHON 74	HBC		Avg. of above two
0.10±0.05	279	² CHALOUKKA 73	HBC	-	3.9 π^-p
••• We do not use the following data for averages, fits, limits, etc. •••					
0.29±0.08	140	¹ KARSHON 74	HBC	0	4.9 π^+p
0.10±0.04	60	¹ KARSHON 74	HBC	+	4.9 π^+p
0.19±0.08		DEFOIX 73	HBC	0	0.7 $\bar{p}p$

NODE=M012R12
 NODE=M012R12

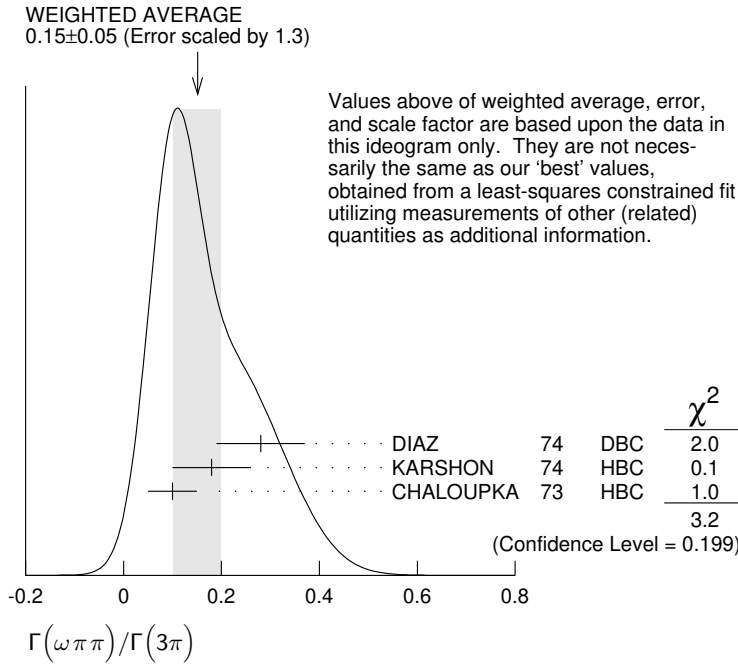
OCCUR=3

OCCUR=2

- ¹ KARSHON 74 suggest an additional $I = 0$ state strongly coupled to $\omega\pi\pi$ which could explain discrepancies in branching ratios and masses. We use a central value and a systematic spread.
- ² Decays to $b_1(1040)\pi$, $b_1 \rightarrow \omega\pi$. Error increased to account for possible systematic errors of complicated analysis.

NODE=M012R12;LINKAGE=K

NODE=M012R12;LINKAGE=01



$\Gamma(K\bar{K})/\Gamma(3\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ_1
0.070±0.012 OUR FIT						
0.078±0.017		CHABAUD	78	RVUE		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
0.011±0.003		¹ BERTIN	98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S \pi^\mp$	
0.056±0.014	50	² CHALOUPKA	73	HBC	- 3.9 $\pi^- p$	
0.097±0.018	113	² ALSTON-...	71	HBC	+ 7.0 $\pi^+ p$	
0.06 ±0.03		² ABRAMOVI...	70B	HBC	- 3.93 $\pi^- p$	
0.054±0.022		² CHUNG	68	HBC	- 3.2 $\pi^- p$	

NODE=M012R1
NODE=M012R1

- ¹ Using 4π data from BERTIN 97D.
- ² Included in CHABAUD 78 review.

NODE=M012R1;LINKAGE=BE
NODE=M012R1;LINKAGE=C

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ_5
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.31 ±0.22 ^{+0.09} / _{-0.11}	¹ KOPF	21	RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$	
0.352±0.011±0.175	² ALBRECHT	20	RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$	
0.08 ±0.02	³ BERTIN	98B	OBLX 0.0 $\bar{p}p \rightarrow K^\pm K_S \pi^\mp$	

NODE=M012R14
NODE=M012R14

- ¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.
- ² Residues from T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\bar{K}$).
- ³ Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R14;LINKAGE=B

NODE=M012R14;LINKAGE=A
NODE=M012R14;LINKAGE=BE

$\Gamma(\eta\pi)/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	$\Gamma_5/(\Gamma_1+\Gamma_5+\Gamma_7)$
0.162±0.012 OUR FIT						
0.140±0.028 OUR AVERAGE						
0.13 ±0.04		ESPIGAT	72	HBC	± 0.0 $\bar{p}p$	
0.15 ±0.04	34	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$	

NODE=M012R2
NODE=M012R2

$\Gamma(K\bar{K})/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$ $\Gamma_7/(\Gamma_1+\Gamma_5+\Gamma_7)$

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M012R8
NODE=M012R8

0.054±0.009 OUR FIT

0.048±0.012 OUR AVERAGE

0.05 ±0.02		TOET	73	HBC	+	5 $\pi^+ p$
0.09 ±0.04		TOET	73	HBC	0	5 $\pi^+ p$
0.03 ±0.02	8	¹ DAMERI	72	HBC	-	11 $\pi^- p$
0.06 ±0.03	17	BARNHAM	71	HBC	+	3.7 $\pi^+ p$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.020±0.004		² ESPIGAT	72	HBC	±	0.0 $\bar{p} p$
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¹ Montanet agrees. Vlada.² Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8;LINKAGE=01
NODE=M012R8;LINKAGE=A

 $\Gamma(\eta'(958)\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M012R4
NODE=M012R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.006	95	ALDE	92B	GAM2		38,100 $\pi^- p \rightarrow \eta' \pi^0 n$
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<0.02	97	BARNHAM	71	HBC	+	3.7 $\pi^+ p$
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0.004±0.004		¹ BOESEBECK	68	HBC	+	8 $\pi^+ p$
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¹ No longer valid since $\Gamma(K\bar{K})/\Gamma(3\pi)$ value has changed (MORRISON 71).

NODE=M012R4;LINKAGE=B

 $\Gamma(\eta'(958)\pi)/\Gamma(3\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M012R5
NODE=M012R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.011	90	EISENSTEIN	73	HBC	-	5 $\pi^- p$
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<0.04		ALSTON-...	71	HBC	+	7.0 $\pi^+ p$
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0.04 $\begin{smallmatrix} +0.03 \\ -0.04 \end{smallmatrix}$		BOECKMANN	70	HBC	0	5.0 $\pi^+ p$
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 $\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$ Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M012R13
NODE=M012R13

0.038±0.005 OUR AVERAGE

0.05 ±0.02	ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
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0.032±0.009	ABELE	97C	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta'$
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0.047±0.010±0.004	¹ BELADIDZE	93	VES	37 $\pi^- N \rightarrow a_2^- N$
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0.034±0.008±0.005	BELADIDZE	92	VES	36 $\pi^- C \rightarrow a_2^- C$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.046±0.015 $\begin{smallmatrix} +0.07 \\ -0.006 \end{smallmatrix}$	² KOPF	21	RVUE	0.9 $p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$
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OCCUR=2

¹ Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 0.236$.

NODE=M012R13;LINKAGE=A

² From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\bar{K}$ systems.

NODE=M012R13;LINKAGE=C

 $\Gamma(\pi^\pm \gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M012R11
NODE=M012R11

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.005 $\begin{smallmatrix} +0.005 \\ -0.003 \end{smallmatrix}$	¹ EISENBERG	72	HBC	4.3,5.25,7.5 γp
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¹ Pion-exchange model used in this estimation.

NODE=M012R11;LINKAGE=R

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M012R15
NODE=M012R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	ACHASOV	00K	SND $e^+ e^- \rightarrow \pi^0 \pi^0$
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a₂(1320) REFERENCES

NODE=M012

KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)	REFID=61470
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=59554
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59471
JACKURA	18	PL B779 464	A. Jackura <i>et al.</i>	(JPAC and COMPASS Collab.)	REFID=59003
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56385
ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=55911
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		REFID=51186
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48317
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)	REFID=48559
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46345
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45531
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=45761
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=45418
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)	REFID=45584
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44649
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)	REFID=43599
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43598
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=43600
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41852
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42171
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)	REFID=41375
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41356
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ALTHOFF	86	ZPHY C31 537	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21287
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=20469
BERGER	84C	PL 149B 427	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=21286
BEHREND	82C	PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
Also		PL 125B 518 (errat.)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
CHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
DELFOSSÉ	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21275
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
CHABAUD	78	NP B145 349	V. Chabaud <i>et al.</i>	(CERN, MPIM)	REFID=21267
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)	REFID=21270
HYAMS	78	NP B146 303	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)	REFID=21271
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA) JP	REFID=21272
MAY	77	PR D16 1983	E.N. May <i>et al.</i>	(ROCH, CORN)	REFID=20450
FORINO	76	NC 35A 465	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)	REFID=21259
MARGULIE	76	PR D14 667	M. Margulies <i>et al.</i>	(BNL, CUNY)	REFID=21261
EMMS	75	PL 58B 117	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL) JP	REFID=21254
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP	REFID=20843
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)	REFID=21248
KARSHON	74	PRL 32 852	U. Karshon <i>et al.</i>	(REHO)	REFID=21249
ANTIPOV	73	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=21238
ANTIPOV	73C	NP B63 153	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=20817
CHALOUPKA	73	PL 44B 211	V. Chaloupka <i>et al.</i>	(CERN)	REFID=21242
CONFORTO	73	PL 45B 154	G. Conforto <i>et al.</i>	(EFI, FNAL, TNTO+)	REFID=21243
DEFOIX	73	PL 43B 141	C. Defoix <i>et al.</i>	(CDEF)	REFID=21244
EISENSTEIN	73	PR D7 278	L. Eisenstein <i>et al.</i>	(ILL)	REFID=21245
KEY	73	PRL 30 503	A.W. Key <i>et al.</i>	(TNTO, EFI, FNAL, WISC)	REFID=21246
TOET	73	NP B63 248	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)	REFID=20714
DAMERI	72	NC 9A 1	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)	REFID=20338
EISENBERG	72	PR D5 15	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)	REFID=20098
ESPIGAT	72	NP B36 93	P. Espigat <i>et al.</i>	(CERN, CDEF)	REFID=21232
FOLEY	72	PR D6 747	K.J. Foley <i>et al.</i>	(BNL, CUNY)	REFID=21233
ALSTON...	71	PL 34B 156	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21214
BARNHAM	71	PRL 26 1494	K.W.J. Barnham <i>et al.</i>	(LBL)	REFID=21215
BINNIE	71	PL 36B 257	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=21217
BOWEN	71	PRL 26 1663	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21219
GRAYER	71	PL 34B 333	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=21223
ABRAMOVI...	70B	NP B23 466	M. Abramovich <i>et al.</i>	(CERN) JP	REFID=21195
ALSTON...	70	PL 33B 607	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21196
BOECKMANN	70	NP B16 221	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)	REFID=21202
ASCOLI	68	PRL 20 1321	G. Ascoli <i>et al.</i>	(ILL) JP	REFID=21171
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CONTE	67	NC 51A 175	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=21166

$f_0(1370)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances" and a note on "Non- $q\bar{q}$ Candidates" in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M147

NODE=M147

 $f_0(1370)$ T-MATRIX POLE \sqrt{s}

NODE=M147PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M147PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1250-1440) -i (60-300) OUR ESTIMATE			
$(1245 \pm 40) - i(300^{+30}_{-70})$	1 PELAEZ	23	RVUE Compilation
$(1380^{+70}_{-60}) - i(220^{+80}_{-70})$	2 PELAEZ	23	RVUE Compilation
$(1370 \pm 40) - i(195 \pm 20)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1280.6 \pm 1.6 \pm 47.4) - i(205.2 \pm 1.7 \pm 20.7)$	3 ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
$(1290 \pm 50) - i(170^{+20}_{-40})$	4 ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1373 \pm 15) - i(137 \pm 10)$	5 BARGIOTTI	03	OBLX $\bar{p}p$
$(1302 \pm 17) - i(166 \pm 18)$	6 BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
$(1312 \pm 25 \pm 10) - i(109 \pm 22 \pm 15)$	BARBERIS	99D	OMEG $450 \bar{p}p \rightarrow K^+K^-, \pi^+\pi^-$
$(1406 \pm 19) - i(80 \pm 6)$	7 KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$(1300 \pm 20) - i(120 \pm 20)$	ANISOVICH	98B	RVUE Compilation
$(1290 \pm 15) - i(145 \pm 15)$	BARBERIS	97B	OMEG $450 \bar{p}p \rightarrow pp2(\pi^+\pi^-)$
$(1548 \pm 40) - i(560 \pm 40)$	BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
$(1380 \pm 40) - i(180 \pm 25)$	ABELE	96B	CBAR $0.0 \bar{p}p \rightarrow \pi^0K_L^0K_L^0$
$(1300 \pm 15) - i(115 \pm 8)$	BUGG	96	RVUE
$(1330 \pm 50) - i(150 \pm 40)$	8 AMSLER	95B	CBAR $\bar{p}p \rightarrow 3\pi^0$
$(1360 \pm 35) - i(150-300)$	8 AMSLER	95C	CBAR $\bar{p}p \rightarrow \pi^0\eta\eta$
$(1390 \pm 30) - i(190 \pm 40)$	9 AMSLER	95D	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1346 - i249	10,11 JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1214 - i168	11,12 TORNQVIST	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1364 - i139	AMSLER	94D	CBAR $\bar{p}p \rightarrow \pi^0\pi^0\eta$
$(1365^{+20}_{-55}) - i(134 \pm 35)$	ANISOVICH	94	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
$(1340 \pm 40) - i(127^{+30}_{-20})$	13 BUGG	94	RVUE $\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
$(1430 \pm 5) - i(73 \pm 13)$	14 KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1420 - i220	15 AU	87	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

NODE=M147PP

→ UNCHECKED ←

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M147PP;LINKAGE=G

NODE=M147PP;LINKAGE=I

NODE=M147PP;LINKAGE=E

NODE=M147PP;LINKAGE=AO

NODE=M147PP;LINKAGE=BG

NODE=M147PP;LINKAGE=PC

NODE=M147PP;LINKAGE=TK

NODE=M147PP;LINKAGE=K

NODE=M147PP;LINKAGE=A

NODE=M147PP;LINKAGE=C

NODE=M147PP;LINKAGE=DD

NODE=M147PP;LINKAGE=BB

NODE=M147PP;LINKAGE=C1

NODE=M147PP;LINKAGE=KM

NODE=M147PP;LINKAGE=H

¹ From forward dispersion relation applied to $\pi\pi$ scattering data.

² From partial-wave dispersion relation applied to $\pi\pi \rightarrow \bar{K}K$ data.

³ T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).

⁴ Another pole is found at $(1510 \pm 130) - i(800^{+100}_{-150})$ MeV.

⁵ Coupled channel analysis of $\pi^+\pi^-\pi^0, K^+K^-\pi^0$, and $K^\pm K_S^0 \pi^\mp$.

⁶ Average between $\pi^+\pi^-\pi^0$ and $2(\pi^+\pi^-)$.

⁷ T-matrix pole on sheet ---.

⁸ Supersedes ANISOVICH 94.

⁹ Coupled-channel analysis of $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$, and $\pi^0\pi^0\eta$ on sheet IV. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

¹⁰ Analysis of data from FALVARD 88.

¹¹ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

¹² Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

¹³ Reanalysis of ANISOVICH 94 data.

¹⁴ T-matrix pole on sheet III.

¹⁵ Analysis of data from OCHS 73, GRAYER 74, BECKER 79, and CASON 83.

$f_0(1370)$ BREIT-WIGNER MASS

NODE=M147205

VALUE (MeV)

DOCUMENT ID

1200 to 1500 OUR ESTIMATE

NODE=M147M

→ UNCHECKED ←

 $\pi\pi$ MODE

NODE=M147M1

NODE=M147M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1400±40		¹ AUBERT 09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
1470 ⁺⁶⁺⁷² ₋₇₋₂₅₅		² UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow \pi^0\pi^0$ $e^+e^- \rightarrow \pi^0\pi^0$
1259±55	2.6k	BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
1309±1±15		³ BUGG 07A	RVUE	0.0 $p\bar{p} \rightarrow 3\pi^0$
1449±13	4.3k	⁴ GARMASH 06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
1350±50		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
1265±30 ⁺²⁰ ₋₃₅		ABLIKIM 05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1434±18±9	848	AITALA 01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
1308±10		BARBERIS 99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
1315±50		BELLAZZINI 99	GAM4	450 $pp \rightarrow p p \pi^0 \pi^0$
1315±30		ALDE 98	GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
1280±55		BERTIN 98	OBLX	0.05-0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1186		^{5,6} TORNQVIST 95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1472±12		ARMSTRONG 91	OMEG	300 $pp \rightarrow p p \pi\pi, p p K\bar{K}$
1275±20		BREAKSTONE90	SFM	62 $pp \rightarrow p p \pi^+ \pi^-$
1420±20		AKESSON 86	SPEC	63 $pp \rightarrow p p \pi^+ \pi^-$
1256		FROGGATT 77	RVUE	$\pi^+ \pi^-$ channel

¹ Breit-Wigner mass.² Breit-Wigner mass. May also be the $f_0(1500)$.³ Reanalysis of ABELE 96C data.⁴ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.⁵ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CA-SON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.⁶ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

NODE=M147M1;LINKAGE=BW

NODE=M147M1;LINKAGE=UE

NODE=M147M1;LINKAGE=BU

NODE=M147M1;LINKAGE=GR

NODE=M147M1;LINKAGE=BB

NODE=M147M1;LINKAGE=FF

 $K\bar{K}$ MODE

NODE=M147M2

NODE=M147M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1422±15±28		¹ AAIJ 19H	LHCB	$pp \rightarrow D^\pm X$
1360±31±28	430	^{2,3} DOBBS 15		$J/\psi \rightarrow \gamma K^+ K^-$
1350±48±15	168	^{2,3} DOBBS 15		$\psi(2S) \rightarrow \gamma K^+ K^-$
1440±6		VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1391±10		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1440±50		BOLONKIN 88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1463±9		ETKIN 82B	MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
1425±15		WICKLUND 80	SPEC	6 $\pi N \rightarrow K^+ K^- N$
~ 1300		POLYCHRO... 79	STRC	7 $\pi^- p \rightarrow n 2 K_S^0$

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the isobar model A.² Using CLEO-c data but not authored by the CLEO Collaboration.³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 346$ MeV.

NODE=M147M2;LINKAGE=F

NODE=M147M2;LINKAGE=A

NODE=M147M2;LINKAGE=B

 4π MODE $2(\pi\pi)_S + \rho\rho$

NODE=M147M3

NODE=M147M3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1395±40		ABELE 01	CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
1374±38		AMSLER 94	CBAR	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
1345±12		ADAMO 93	OBLX	$\bar{n}p \rightarrow 3\pi^+ 2\pi^-$
1386±30		GASPERO 93	DBC	0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$
~ 1410	5751	¹ BETTINI 66	DBC	0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$

¹ $\rho\rho$ dominant.

NODE=M147M3;LINKAGE=BE

$\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1262^{+51+82}_{-78-103}$	¹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
1430	AMSLER	92 CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \eta\eta$
1220 ± 40	ALDE	86D GAM4	$100 \pi^- p \rightarrow n2\eta$

¹ Breit-Wigner mass. May also be the $f_0(1500)$.

NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1330.2^{+5.9}_{-6.5} \pm 5.1$	¹ AAIJ	19H LHCB	$pp \rightarrow D^\pm X$
1306 ± 20	² ANISOVICH	03 RVUE	

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.

² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147M5
NODE=M147M5

NODE=M147M5;LINKAGE=A

NODE=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID
200 to 500 OUR ESTIMATE	

NODE=M147210

NODE=M147W
→ UNCHECKED ←

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
300 ± 80		¹ AUBERT	09L BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90^{+2+50}_{-1-22}		² UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
298 ± 21	2.6k	BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
126 ± 25	4286	³ GARMASH	06 BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$350 \pm 100^{+105}_{-60}$		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
$173 \pm 32 \pm 6$	848	AITALA	01A E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
222 ± 20		BARBERIS	99B OMEG	$450 pp \rightarrow p_S p_f \pi^+ \pi^-$
255 ± 60		BELLAZZINI	99 GAM4	$450 pp \rightarrow pp \pi^0 \pi^0$
190 ± 50		ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
323 ± 13		BERTIN	98 OBLX	$0.05-0.405 \bar{p}p \rightarrow \pi^+ \pi^+ \pi^-$
350		^{4,5} TORNQVIST	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
195 ± 33		ARMSTRONG	91 OMEG	$300 pp \rightarrow pp\pi\pi, ppK\bar{K}$
285 ± 60		BREAKSTONE	90 SFM	$62 pp \rightarrow pp\pi^+ \pi^-$
460 ± 50		AKESSON	86 SPEC	$63 pp \rightarrow pp\pi^+ \pi^-$
~ 400		⁶ FROGGATT	77 RVUE	$\pi^+ \pi^-$ channel

¹ The systematic errors are not reported.

² Breit-Wigner width. May also be the $f_0(1500)$.

³ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.

⁴ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CA-SON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

⁵ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

⁶ Width defined as distance between 45 and 135° phase shift.

NODE=M147W1
NODE=M147W1

NODE=M147W1;LINKAGE=NS
NODE=M147W1;LINKAGE=UE
NODE=M147W1;LINKAGE=GR
NODE=M147W1;LINKAGE=BB

NODE=M147W1;LINKAGE=FF
NODE=M147W1;LINKAGE=E

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$324 \pm 38 \pm 42$	¹ AAIJ	19H LHCB	$pp \rightarrow D^\pm X$
121 ± 15	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
55 ± 26	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
250 ± 80	BOLONKIN 88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
118^{+138}_{-16}	ETKIN 82B	MPS	$23 \pi^- p \rightarrow n2K_S^0$
160 ± 30	WICKLUND 80	SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 150	POLYCHRO... 79	STRC	$7 \pi^- p \rightarrow n2K_S^0$

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the isobar model A.

NODE=M147W2
NODE=M147W2

OCCUR=3

NODE=M147W2;LINKAGE=C

4 π MODE 2($\pi\pi$) $_S$ + $\rho\rho$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
275 \pm 55		ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
375 \pm 61		AMSLER	94	CBAR 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
398 \pm 26		ADAMO	93	OBLX $\bar{n}p \rightarrow 3\pi^+ 2\pi^-$
310 \pm 50		GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$
\sim 90	5751	¹ BETTINI	66	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$

¹ $\rho\rho$ dominant.

NODE=M147W3
NODE=M147W3

NODE=M147W3;LINKAGE=BE

 $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
484 $^{+246+246}_{-170-263}$	¹ UEHARA	10A	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$
250	AMSLER	92	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \eta\eta$
320 \pm 40	ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2\eta$

¹ Breit-Wigner width. May also be the $f_0(1500)$.

NODE=M147W4
NODE=M147W4

NODE=M147W4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
147 $^{+30}_{-50}$	¹ ANISOVICH	03	RVUE

¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147W5
NODE=M147W5

NODE=M147W;LINKAGE=KM

 $f_0(1370)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 4π	seen
Γ_3 $4\pi^0$	seen
Γ_4 $2\pi^+ 2\pi^-$	seen
Γ_5 $\pi^+ \pi^- 2\pi^0$	seen
Γ_6 $\rho\rho$	seen
Γ_7 $2(\pi\pi)_S$ -wave	seen
Γ_8 $\pi(1300)\pi$	seen
Γ_9 $a_1(1260)\pi$	seen
Γ_{10} $\eta\eta$	seen
Γ_{11} $K\bar{K}$	seen
Γ_{12} $K\bar{K}n\pi$	not seen
Γ_{13} 6π	not seen
Γ_{14} $\omega\omega$	not seen
Γ_{15} $\gamma\gamma$	seen
Γ_{16} $e^+ e^-$	not seen

NODE=M147215;NODE=M147

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=15;OUR EST;→ UNCHECKED ←
DESIG=16;OUR EVAL;→ UNCHECKED ←
DESIG=17;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=18;OUR EVAL;→ UNCHECKED ←
DESIG=19;OUR EVAL;→ UNCHECKED ←
DESIG=20;OUR EVAL;→ UNCHECKED ←
DESIG=12;OUR EST;→ UNCHECKED ←
DESIG=13;OUR EST;→ UNCHECKED ←

 $f_0(1370)$ PARTIAL WIDTHS **$\Gamma(\gamma\gamma)$**

See $\gamma\gamma$ widths under $f_0(500)$ and MORGAN 90.

Γ_{15}

NODE=M147217

NODE=M147W11
NODE=M147W11
NODE=M147W11

 $\Gamma(e^+ e^-)$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<20	90	VOROBYEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$

Γ_{16}

NODE=M147W12
NODE=M147W12

$f_0(1370) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M147225

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{10}\Gamma_{15}/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M147G01
NODE=M147G01

• • • We do not use the following data for averages, fits, limits, etc. • • •

$121^{+133+169}_{-53-106}$	¹ UEHARA	10A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$
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¹Including interference with the $f'_2(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M147G01;LINKAGE=UE

 $f_0(1370) \text{ BRANCHING RATIOS}$

NODE=M147220

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M147R3
NODE=M147R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.10	95	OCHS	13	RVUE
0.26 ± 0.09		BUGG	96	RVUE
<0.15		¹ AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+\pi^-3\pi^0$
<0.06		GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$

¹Using AMSLER 95B ($3\pi^0$).

NODE=M147R3;LINKAGE=B

 $\Gamma(4\pi)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma = (\Gamma_3+\Gamma_4+\Gamma_5)/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R4
NODE=M147R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.72	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$
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 $\Gamma(4\pi^0)/\Gamma(4\pi)$ Γ_3/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R12
NODE=M147R12

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	ABELE	96	CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$
0.068 ± 0.005	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$

¹Model-dependent evaluation.

NODE=M147R12;LINKAGE=GA

 $\Gamma(2\pi^+2\pi^-)/\Gamma(4\pi)$ $\Gamma_4/\Gamma_2 = \Gamma_4/(\Gamma_3+\Gamma_4+\Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R5
NODE=M147R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.420 ± 0.014	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+3\pi^-$
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¹Model-dependent evaluation.

NODE=M147R5;LINKAGE=A

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(4\pi)$ $\Gamma_5/\Gamma_2 = \Gamma_5/(\Gamma_3+\Gamma_4+\Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R6
NODE=M147R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.512 ± 0.019	¹ GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$
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¹Model-dependent evaluation.

NODE=M147R6;LINKAGE=A

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_6/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R17
NODE=M147R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.26 ± 0.07	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi\rho$
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 $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(\pi\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R15
NODE=M147R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.6 ± 2.6	¹ ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^-4\pi^0\rho$
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¹From the combined data of ABELE 96 and ABELE 96C.

NODE=M147R;LINKAGE=KZ

 $\Gamma(2(\pi\pi)_{S\text{-wave}})/\Gamma(4\pi)$ Γ_7/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R16
NODE=M147R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.51 ± 0.09	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi\rho$
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$\Gamma(\rho\rho)/\Gamma(2(\pi\pi)_{S\text{-wave}})$ Γ_6/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R10
 NODE=M147R10

••• We do not use the following data for averages, fits, limits, etc. •••

large	BARBERIS	00C	450 $p\rho \rightarrow \rho_f 4\pi p_S$
1.6 \pm 0.2	AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
\sim 0.65	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow$ hadrons

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_8/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R18
 NODE=M147R18

••• We do not use the following data for averages, fits, limits, etc. •••

0.17 \pm 0.06	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi\rho$
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 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_9/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R19
 NODE=M147R19

••• We do not use the following data for averages, fits, limits, etc. •••

0.06 \pm 0.02	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi\rho$
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 $\Gamma(\eta\eta)/\Gamma(4\pi)$ $\Gamma_{10}/\Gamma_2 = \Gamma_{10}/(\Gamma_3 + \Gamma_4 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R14
 NODE=M147R14

••• We do not use the following data for averages, fits, limits, etc. •••

(28 \pm 11) $\times 10^{-3}$	¹ ANISOVICH	02D	SPEC Combined fit
(4.7 \pm 2.0) $\times 10^{-3}$	BARBERIS	00E	450 $p\rho \rightarrow \rho_f \eta\eta p_S$

¹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$), GAMS ($\pi\rho \rightarrow \pi^0 \pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi\rho \rightarrow K\bar{K}n$) data.

NODE=M147R14;LINKAGE=CH

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R11
 NODE=M147R11

••• We do not use the following data for averages, fits, limits, etc. •••

0.35 \pm 0.13	BUGG	96	RVUE
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 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R13
 NODE=M147R13

••• We do not use the following data for averages, fits, limits, etc. •••

0.08 \pm 0.08	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi\pi^+\pi^-, \phi K^+ K^-$
0.91 \pm 0.20	¹ BARGIOTTI	03	OBLX $\bar{p}p$
0.12 \pm 0.06	² ANISOVICH	02D	SPEC Combined fit
0.46 \pm 0.15 \pm 0.11	BARBERIS	99D	OMEG 450 $p\rho \rightarrow K^+ K^-, \pi^+ \pi^-$

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$), GAMS ($\pi\rho \rightarrow \pi^0 \pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi\rho \rightarrow K\bar{K}n$) data.

NODE=M147R;LINKAGE=BG
 NODE=M147R;LINKAGE=CH

 $\Gamma(K\bar{K}n\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R20
 NODE=M147R20

••• We do not use the following data for averages, fits, limits, etc. •••

< 0.03	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow$ hadrons
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 $\Gamma(6\pi)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R21
 NODE=M147R21

••• We do not use the following data for averages, fits, limits, etc. •••

< 0.22	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow$ hadrons
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 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M147R22
 NODE=M147R22

••• We do not use the following data for averages, fits, limits, etc. •••

< 0.13	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow$ hadrons
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f₀(1370) REFERENCES

NODE=M147

PELAEZ	23	PRL 130 051902	J.R. Pelaez, A. Rodas, J. Ruiz de Elvira (MADU+)	REFID=62199
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i> (BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i> (Crystal Barrel Collab.)	REFID=60439
AAJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i> (LHCb Collab.)	REFID=59670
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>	REFID=59987
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i> (NWES)	REFID=56805
OCHS	13	JP G40 043001	W. Ochs	REFID=55367
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i> (BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev (PNPI)	REFID=52719
AUBERT	09L	PR D79 072006	B. Aubert <i>et al.</i> (BABAR Collab.)	REFID=52723
PDG	08	PL B667 1	C. Amsler <i>et al.</i> (PDG Collab.)	REFID=52166
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i> (BELLE Collab.)	REFID=52309
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i> (CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>	REFID=53252
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=51594
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=51162
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i> (PDG Collab.)	REFID=51004
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i> (ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.		
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i> (BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i> (BES Collab.)	REFID=50958
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=50641
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	REFID=49401
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i> (OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	REFID=49423
		Translated from YAF 66 860.		
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	REFID=48831
		Translated from YAF 65 1583.		
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=48356
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i> (FNAL E791 Collab.)	REFID=48004
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i> (CLEO Collab.)	REFID=47339
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=47959
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=47961
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i> (Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i> (Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>	REFID=47400
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau (CRAC, PARIN)	REFID=46927
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i> (GAM4 Collab.)	REFID=46605
		Also PAN 62 405	D. Alde <i>et al.</i> (GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.		
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	REFID=46331
		Translated from UFN 168 481.		
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i> (OBELIX Collab.)	REFID=45782
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=45758
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i> (OBELIX Collab.)	REFID=45701
ABELE	96	PL B380 453	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45011
ABELE	96B	PL B385 425	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45038
ABELE	96C	NP A609 562	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45076
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou (LOQM, PNPI)	REFID=45094
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44377
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44440
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44441
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i> (STON, ADLD, JULI)	REFID=44508
TORNQVIST	95	ZPHY C68 647	N.A. Tornqvist (HELS)	REFID=44529
AMSLER	94	PL B322 431	C. Amsler <i>et al.</i> (Crystal Barrel Collab.) JPC	REFID=43660
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i> (Crystal Barrel Collab.) JPC	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i> (LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet (CRAC+)	REFID=45771
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i> (OBELIX Collab.) JPC	REFID=43657
GASPERO	93	NP A562 407	M. Gaspero (ROMA1) JPC	REFID=43658
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i> (ATHU, BARI, BIRM+)	REFID=41744
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i> (ATHU, BARI, BIRM+)	REFID=41862
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i> (ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington (RAL, DURH)	REFID=41583
ASTON	88	NP B296 493	D. Aston <i>et al.</i> (SLAC, NAGO, CINC, INUS)	REFID=40262
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i> (ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i> (CLER, FRAS, LALO+)	REFID=40576
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i> (NOVO)	REFID=41023
		Translated from YAF 48 436.		
AU	87	PR D35 1633	K.L. Au, D. Morgan, M.R. Pennington (DURH, RAL)	REFID=40064
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i> (Axial Field Spec. Collab.)	REFID=21123
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i> (BELG, LAPP, SERP, CERN+)	REFID=20765
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i> (BNL, BRAN, CUNY+)	REFID=20768
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i> (BELG, LAPP, SERP+)	REFID=21418
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i> (BELG, LAPP, SERP+)	REFID=20750
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i> (NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i> (BNL, CUNY, TUFTS, VAND)	REFID=20390
WICKLUND	80	PRL 45 1469	A.B. Wicklund <i>et al.</i> (ANL)	REFID=20383
BECKER	79	NP B151 46	H. Becker <i>et al.</i> (MPIM, CERN, ZEEM, CRAC)	REFID=21084
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i> (NDAM, ANL)	REFID=20378
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen (GLAS, NORD)	REFID=21072
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i> (GEVA, SACL)	REFID=11004
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i> (CERN, MPIM)	REFID=20355
GRAYR	74	NP B75 189	G. Grayer <i>et al.</i> (CERN, MPIM)	REFID=20113
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i> (CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs (MPIM, MUNI)	REFID=20349
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i> (PENN)	REFID=44530
BETTINI	66	NC 42A 695	A. Bettini <i>et al.</i> (PADO, PISA)	REFID=21361

$\pi_1(1400)$

$I^G(J^{PC}) = 1^-(1^-+)$

OMITTED FROM SUMMARY TABLE

Coupled channel analyses favor the existence of only one broad 1^-+ isovector state consistent with $\pi_1(1600)$ in the 1400–1600 MeV region. See the review on "Spectroscopy of Light Meson Resonances". See also $\pi_1(1600)$.

NODE=M111

NODE=M111

$\eta(1405)$

$I^G(J^{PC}) = 0^+(0^-+)$

See also the $\eta(1475)$.

NODE=M027

NODE=M027

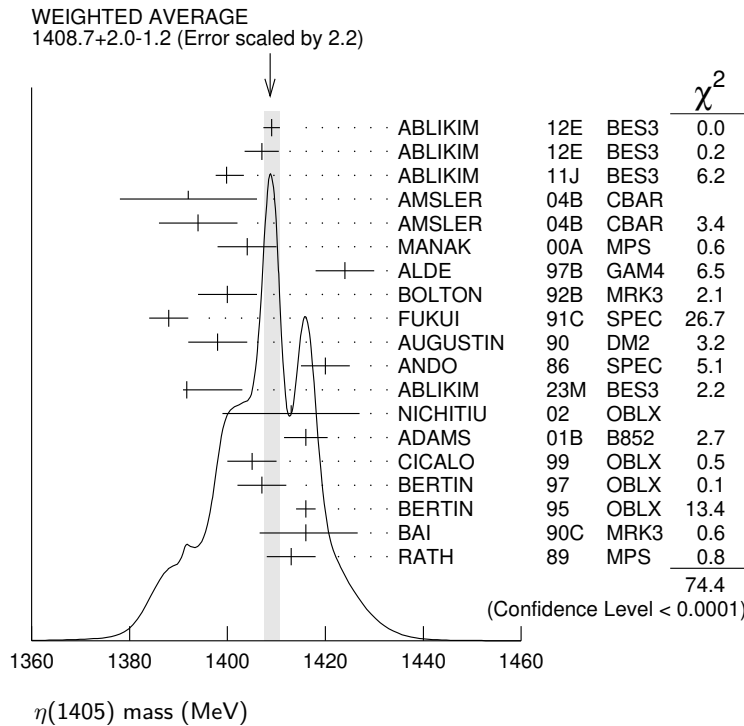
$\eta(1405)$ MASS

NODE=M027205

NODE=M027MX

VALUE (MeV) DOCUMENT ID

1408.7^{+2.0}_{-1.2} OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 2.2. See the ideogram below.



$\eta\pi\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

1405.8 \pm 2.6 OUR AVERAGE Error includes scale factor of 2.3. See the ideogram below.

1409.0 \pm 1.7	743	ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$	
1407.0 \pm 3.5	198	ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$	OCCUR=2
1399.8 \pm 2.2 ^{+2.8} _{-0.1}	1	ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$	
1392 \pm 14	900 \pm 375	AMSLER	04B	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$	
1394 \pm 8	6.6 \pm 2.0k	AMSLER	04B	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$	OCCUR=2
1404 \pm 6	9082	MANAK	00A	MPS	$18 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	
1424 \pm 6	2200	ALDE	97B	GAM4	$100 \pi^-\rho \rightarrow \eta\pi^0\pi^0n$	
1400 \pm 6		2 BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1388 \pm 4		FUKUI	91C	SPEC	$8.95 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	
1398 \pm 6	261	3 AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1420 \pm 5		ANDO	86	SPEC	$8 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	

NODE=M027M1

NODE=M027M1

OCCUR=2

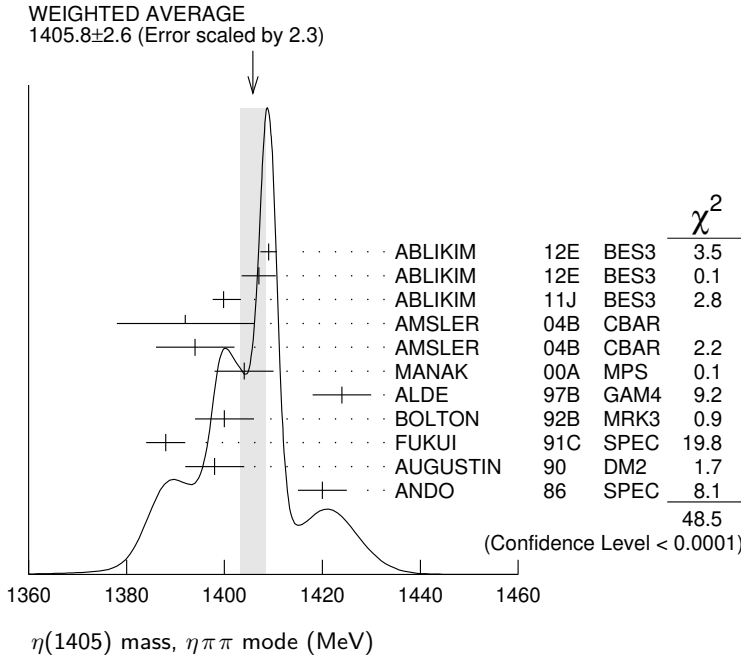
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1404.0 ± 11.0	195	ABLIKIM	19BABES3	$e^+e^- \rightarrow \psi(2S)$
1385 ± 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
1409 ± 3		⁴ AMSLER	95F CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

- ¹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.
- ² From fit to the $a_0(980)\pi 0^-+$ partial wave.
- ³ Best fit with a single Breit Wigner.
- ⁴ Superseded by AMSLER 04B.

NODE=M027M1;LINKAGE=BL
 NODE=M027M1;LINKAGE=J1
 NODE=M027M1;LINKAGE=A1
 NODE=M027M1;LINKAGE=A



$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M027M4
 NODE=M027M4

The data in this block is included in the average printed for a previous datablock.

1413.5^{+2.0}_{-0.9} OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

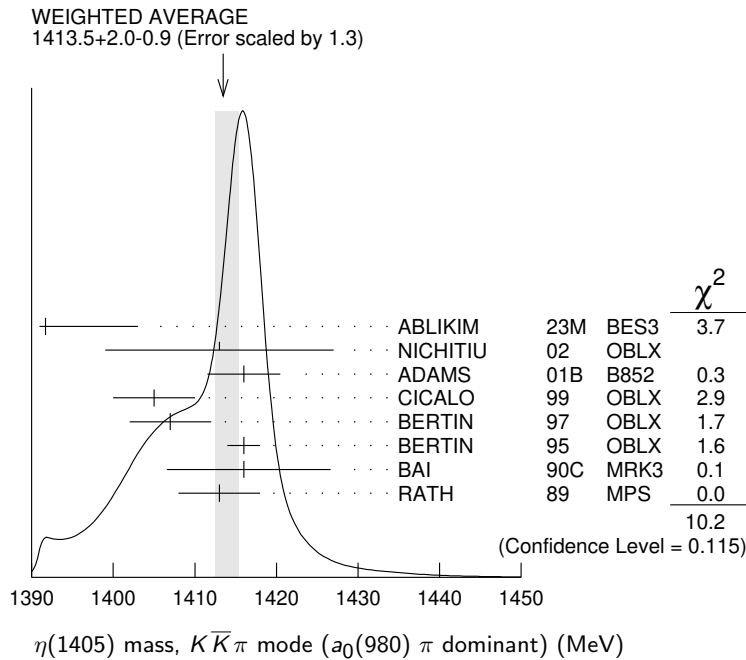
1391.7 ± 0.7 ^{+11.3} _{-0.3}	126k	¹ ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$	
1413 ± 14	3651	² NICHITIU	02	OBLX	$0\bar{p}p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	
1416 ± 4 ± 2	20k	ADAMS	01B	B852	$18\text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$	
1405 ± 5		³ CICALO	99	OBLX	$0\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$	
1407 ± 5		³ BERTIN	97	OBLX	$0\bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$	
1416 ± 2		³ BERTIN	95	OBLX	$0\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$	
1416 ± 8 ⁺⁷ ₋₅	700	⁴ BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$	OCCUR=2
1413 ± 5		⁴ RATH	89	MPS	$21.4\text{ } \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$	OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

1459 ± 5		⁵ AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$	
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- ¹ ABLIKIM 23M reports for this state a significance from the fit much higher than 35 σ .
- ² Decaying dominantly directly to $K^+ K^- \pi^0$.
- ³ Decaying into $(K\bar{K})_S \pi$, $(K\pi)_S \bar{K}$, and $a_0(980)\pi$.
- ⁴ From fit to the $a_0(980)\pi 0^-+$ partial wave. Cannot rule out a $a_0(980)\pi 1^++$ partial wave.
- ⁵ Excluded from averaging because averaging would be meaningless.

NODE=M027M4;LINKAGE=A
 NODE=M027M;LINKAGE=NC
 NODE=M027M4;LINKAGE=FX
 NODE=M027M4;LINKAGE=C2
 NODE=M027M4;LINKAGE=AA



$\pi\pi\gamma$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1403±17 OUR AVERAGE				Error includes scale factor of 1.8.
1390±12	235 ± 91	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
1424±10±11	547	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1401±18		^{1,2} AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
1432± 8		² COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+\pi^-2\gamma$

NODE=M027M2
NODE=M027M2

¹ Best fit with a single Breit Wigner.

² This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.

OCCUR=4

NODE=M027M2;LINKAGE=E
NODE=M027M2;LINKAGE=X

4π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1420±20		BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1489±12	3270	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ Estimated by us from various fits.

NODE=M027M3
NODE=M027M3

NODE=M027M3;LINKAGE=E

$K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1452.7± 3.3	191	^{1,2} ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
1437.6± 3.2	249 ± 35	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + c.c.$
1445.9± 5.7	62 ± 18	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
1442 ± 10	410	¹ BAI	98C BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1445 ± 8	693	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1433 ± 8	296	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1413 ± 8	500	¹ DUCH	89 ASTE	$\bar{p}p \rightarrow \pi^+\pi^- K^\pm \pi^\mp K^0$
1453 ± 7	170	¹ RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1419 ± 1	8800	¹ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ K^0 \pi^- n$
1424 ± 3	620	¹ REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K\bar{K}\pi X$
1421 ± 2		¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K\bar{K}\pi n$
1440 ⁺²⁰ ₋₁₅	174	¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
1440 ⁺¹⁰ ₋₁₅		¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 7	800	^{1,3} BAILLON	67 HBC	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$

¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.

² Systematic uncertainty not evaluated.

³ From best fit of 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.

NODE=M027M6
NODE=M027M6

NODE=M027M;LINKAGE=NP

NODE=M027M;LINKAGE=NS

NODE=M027M6;LINKAGE=H

$\eta(1405)$ WIDTH

NODE=M027210

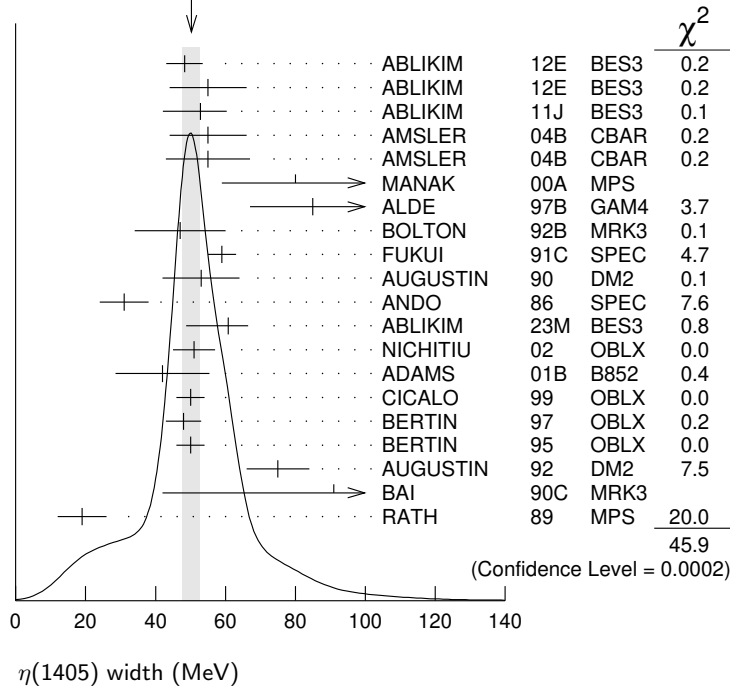
NODE=M027WX

VALUE (MeV)

DOCUMENT ID

50.3±2.5 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.6. See the ideogram below.

WEIGHTED AVERAGE
50.3±2.5 (Error scaled by 1.6)



$\eta\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M027W1

NODE=M027W1

The data in this block is included in the average printed for a previous datablock.

52.6± 3.2 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

48.3± 5.2	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$	
55.0±11.0	198	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$	OCCUR=2
52.8± 7.6 ^{+0.1} _{-7.6}	1	ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$	
55 ±11	900	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$	
55 ±12	6.6k	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\gamma$	OCCUR=2
80 ±21	9.0k	MANAK	00A MPS	$18 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	
85 ±18	2.2k	ALDE	97B GAM4	$100 \pi^-\rho \rightarrow \eta\pi^0\pi^0n$	
47 ±13	2	BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
59 ± 4		FUKUI	91C SPEC	$8.95 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	
53 ±11	3	AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
31 ± 7		ANDO	86 SPEC	$8 \pi^-\rho \rightarrow \eta\pi^+\pi^-n$	

••• We do not use the following data for averages, fits, limits, etc. •••

79.0±16.0	195	ABLIKIM	19BA BES3	$e^+e^- \rightarrow \psi(2S)$	
86 ±10	4	AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$	

¹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

² From fit to the $a_0(980)\pi^0\pi^+\pi^-$ partial wave.

³ From $\eta\pi^+\pi^-$ mass distribution - mainly $a_0(980)\pi^-$ - no spin-parity determination available.

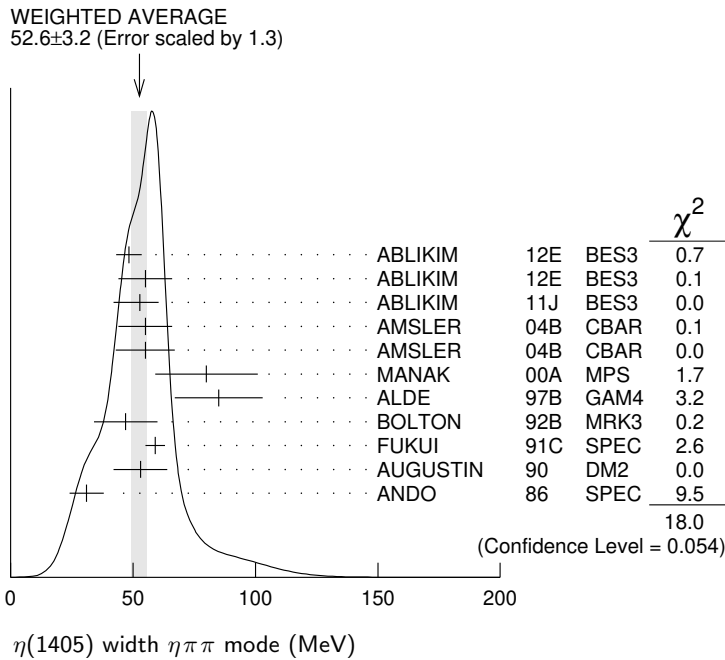
⁴ Superseded by AMSLER 04B.

NODE=M027W1;LINKAGE=BL

NODE=M027W1;LINKAGE=A1

NODE=M027W1;LINKAGE=D1

NODE=M027W1;LINKAGE=A



$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M027W4
NODE=M027W4

49 ± 4 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.

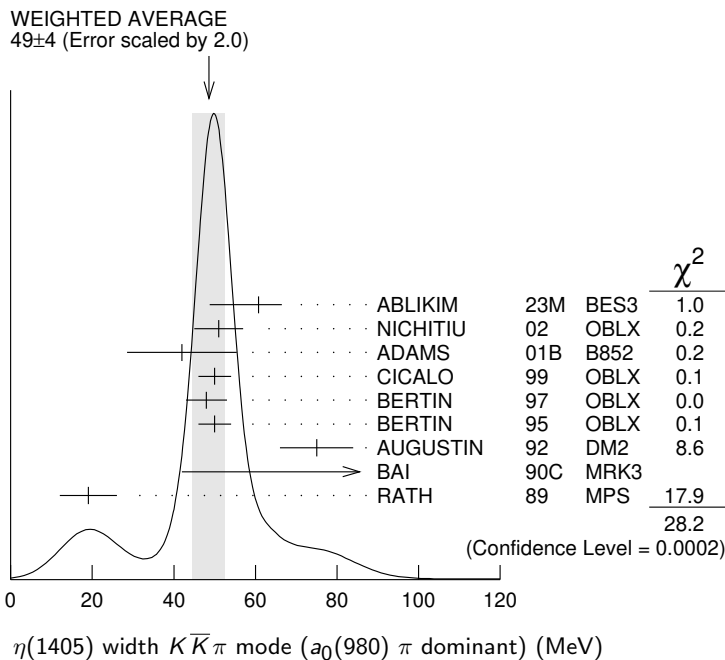
60.8 ± 1.2 ^{+5.5} _{-12.0}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
51 ± 6	3651	¹ NICHITIU	02 OBLX	$0 \bar{p}p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
42 ± 10 ± 9	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
50 ± 4		CICALO	99 OBLX	$0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
48 ± 5	² BERTIN	97 OBLX	0.0	$\bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
50 ± 4	² BERTIN	95 OBLX	0	$\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
75 ± 9	AUGUSTIN	92 DM2		$J/\psi \rightarrow \gamma K\bar{K}\pi$
91 ⁺⁶⁷ ₋₃₁ ⁺¹⁵ ₋₃₈	3 BAI	90C MRK3		$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
19 ± 7	³ RATH	89 MPS	21.4	$\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=3

- ¹Decaying dominantly directly to $K^+ K^- \pi^0$.
- ²Decaying into $(K\bar{K})_S \pi$, $(K\pi)_S \bar{K}$, and $a_0(980)\pi$.
- ³From fit to the $a_0(980)\pi 0^- +$ partial wave, but $a_0(980)\pi 1^+ +$ cannot be excluded.

NODE=M027W;LINKAGE=NC
NODE=M027W4;LINKAGE=FX
NODE=M027W4;LINKAGE=C



$\pi\pi\gamma$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
89 ±17	OUR AVERAGE	Error includes scale factor of 1.7.		
64 ±18	235 ± 91	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
101.0 ± 8.8 ± 8.8	547	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
174 ±44		AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
90 ±26		¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+\pi^-2\gamma$

¹ This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.

NODE=M027W2
NODE=M027W2

OCCUR=2

NODE=M027W2;LINKAGE=X

4 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
160 ±30		BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
144 ±13	3270	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ Estimated by us from various fits.

NODE=M027W3
NODE=M027W3

NODE=M027W3;LINKAGE=F2

 $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
45.9 ± 8.2	191	^{1,2} ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
48.9 ± 9.0	249 ± 35	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + c.c.$
34.2 ± 18.5	62 ± 18	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
93 ± 14	296	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
105 ± 10	693	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
62 ± 16	500	¹ DUCH	89 ASTE	$\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
100 ± 11	170	¹ RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
66 ± 2	8800	¹ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
60 ± 10	620	¹ REEVES	86 SPEC	$6.6 p\bar{p} \rightarrow K K \pi X$
60 ± 10		¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K\bar{K}\pi n$
55 ⁺²⁰ / ₋₃₀	174	¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
50 ⁺³⁰ / ₋₂₀		¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
80 ± 10	800	^{1,3} BAILLON	67 HBC	$0.0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$

¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.

² Systematic uncertainty not evaluated.

³ From best fit to 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.

NODE=M027W6
NODE=M027W6

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M027W;LINKAGE=NP

NODE=M027W;LINKAGE=NS

NODE=M027W6;LINKAGE=H1

 $\eta(1405)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\bar{K}\pi$	seen	DESIG=2;OUR EST;→ UNCHECKED ←
Γ_2 $\eta\pi\pi$	seen	DESIG=5;OUR EST;→ UNCHECKED ←
Γ_3 $a_0(980)\pi$	seen	DESIG=4;OUR EST;→ UNCHECKED ←
Γ_4 $\eta(\pi\pi)_S$ -wave	seen	DESIG=9;OUR EST;→ UNCHECKED ←
Γ_5 $f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0$		DESIG=15
Γ_6 $f_0(980)\eta$	seen	DESIG=10;OUR EST;→ UNCHECKED ←
Γ_7 4π	seen	DESIG=6;OUR EVAL;→ UNCHECKED ←
Γ_8 $\rho\rho$	<58 %	99.85% DESIG=12
Γ_9 $\gamma\gamma$		DESIG=7
Γ_{10} $\rho^0\gamma$	seen	DESIG=8;OUR EST;→ UNCHECKED ←
Γ_{11} $\phi\gamma$		DESIG=13
Γ_{12} $K^*(892)K$	seen	DESIG=11;OUR EST;→ UNCHECKED ←

NODE=M027215;NODE=M027

 $\eta(1405)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_9/\Gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.035	90	^{1,2} AHOHE	05 CLE2	$10.6 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$	

¹ Using $\eta(1405)$ mass and width 1410 MeV and 51 MeV, respectively.

² Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M027220

NODE=M027G3
NODE=M027G3

NODE=M027G3;LINKAGE=AH

NODE=M027G3;LINKAGE=B3

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_9/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.095	95	ACCIARRI	01G L3	183-202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$

NODE=M027G5
NODE=M027G5

 $\Gamma(\rho^0\gamma) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{10}\Gamma_9/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5	95	ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
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NODE=M027G8
NODE=M027G8

 $\eta(1405)$ BRANCHING RATIOS

NODE=M027225

 $\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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1.09±0.48 ¹ AMSLER 04B CBAR 0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.5 90 EDWARDS 83B CBAL $J/\psi \rightarrow \eta\pi\pi\gamma$

<1.1 90 SCHARRE 80 MRK2 $J/\psi \rightarrow \eta\pi\pi\gamma$

<1.5 95 FOSTER 68B HBC 0.0 $\bar{p}p$

¹ Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.

NODE=M027R3
NODE=M027R3

NODE=M027R3;LINKAGE=AM

 $\Gamma(\rho^0\gamma)/\Gamma(\eta\pi\pi)$ Γ_{10}/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
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0.111±0.064 AMSLER 04B CBAR 0 $\bar{p}p$

NODE=M027R12
NODE=M027R12

 $\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}\pi)$ Γ_3/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.15 ¹ BERTIN 95 OBLX 0 $\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$

~ 0.8 500 ¹ DUCH 89 ASTE $\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$

~ 0.75 ¹ REEVES 86 SPEC 6.6 $p\bar{p} \rightarrow KK\pi X$

¹ Assuming that the $a_0(980)$ decays only into $K\bar{K}$.

NODE=M027R4
NODE=M027R4

NODE=M027R4;LINKAGE=C

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$ Γ_3/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.29±0.10 ABELE 98E CBAR 0 $p\bar{p} \rightarrow \eta\pi^0\pi^0\pi^0$

0.19±0.04 2200 ¹ ALDE 97B GAM4 100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

0.56±0.04±0.03 ¹ AMSLER 95F CBAR 0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

¹ Assuming that the $a_0(980)$ decays only into $\eta\pi$.

NODE=M027R2
NODE=M027R2

NODE=M027R2;LINKAGE=A

 $\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)S\text{-wave})$ Γ_3/Γ_4

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.91±0.12 ANISOVICH 01 SPEC 0.0 $\bar{p}p \rightarrow \eta\pi^+\pi^-\pi^+\pi^-$

0.15±0.04 9082 ¹ MANAK 00A MPS 18 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

0.70±0.12±0.20 ² BAI 99 BES $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

¹ Statistical error only.

² Assuming that the $a_0(980)$ decays only into $\eta\pi$.

NODE=M027R9
NODE=M027R9

NODE=M027R;LINKAGE=K3
NODE=M027R9;LINKAGE=BK

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{10}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.0152±0.0038 ¹ COFFMAN 90 MRK3 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

¹ Using $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi)=4.2 \times 10^{-3}$ and $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma\gamma\rho^0)=6.4 \times 10^{-5}$.

NODE=M027R7
NODE=M027R7

NODE=M027R7;LINKAGE=D

 $\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.78 × 10⁻³ 90 ¹ ABLIKIM 180 BES3 $\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

¹ Using results from BAI 00D.

NODE=M027R02
NODE=M027R02

NODE=M027R02;LINKAGE=A

 $\Gamma(\eta(\pi\pi)S\text{-wave})/\Gamma(\eta\pi\pi)$ Γ_4/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.81±0.04 2200 ALDE 97B GAM4 100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

NODE=M027R8
NODE=M027R8

$\Gamma(f_0(980)\eta)/\Gamma(\eta\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.32±0.07 ¹ ANISOVICH 00 SPEC 0.9–1.2 $\bar{p}p \rightarrow \eta 3\pi^0$

¹ Using preliminary Crystal Barrel data.

 Γ_6/Γ_2

NODE=M027R10
NODE=M027R10

NODE=M027R10;LINKAGE=D

 $\Gamma(f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

seen 203 ¹ ABLIKIM 24I BES3 $J/\psi \rightarrow e^+e^-\eta(1405)$
seen 743 ² ABLIKIM 12E BES3 $J/\psi \rightarrow \gamma\eta(1405)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ³ ABLIKIM 17AJ BES3 $\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

¹ ABLIKIM 24I reports $B(J/\psi \rightarrow e^+e^-\eta(1405) \rightarrow f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0) = (2.04 \pm 0.20 \pm 0.08) \times 10^{-7}$.

² ABLIKIM 12E reports $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0) = (1.5 \pm 0.11 \pm 0.11) \times 10^{-5}$ and $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow f_0(980)\pi^0 \rightarrow \pi^0\pi^0\pi^0) = (7.10 \pm 0.82 \pm 0.72) \times 10^{-6}$.

³ ABLIKIM 17AJ reports $B(\psi(2S) \rightarrow \gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0) < 5.0 \times 10^{-7}$.

 Γ_5/Γ

NODE=M027R00
NODE=M027R00

NODE=M027R00;LINKAGE=C

NODE=M027R00;LINKAGE=D

NODE=M027R00;LINKAGE=A

 $\Gamma(\rho\rho)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.58 99.85 ^{1,2} AMSLER 04B CBAR 0 $\bar{p}p$

¹ Assuming that the $\eta(1405)$ decays are saturated by the $\pi\pi\eta$, $K\bar{K}\pi$ and $\rho\rho$ modes.

² Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.

 Γ_8/Γ

NODE=M027R13
NODE=M027R13

NODE=M027R13;LINKAGE=AM
NODE=M027R13;LINKAGE=AS

 $\Gamma(K^*(892)K)/\Gamma(a_0(980)\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.084±0.024 ¹ ADAMS 01B B852 18 GeV $\pi^-p \rightarrow K^+K^-\pi^0n$

¹ Statistical error only.

 Γ_{12}/Γ_3

NODE=M027R11
NODE=M027R11

NODE=M027R11;LINKAGE=K3

 $\Gamma(\phi\gamma)/\Gamma(\rho^0\gamma)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.09±0.03 ¹ ABLIKIM 18I BES3 $J/\psi \rightarrow \gamma\gamma\phi(1020)$

0.13±0.04 ² ABLIKIM 18I BES3 $J/\psi \rightarrow \gamma\gamma\phi(1020)$

<0.77 95 ³ BAI 04J BES2 $J/\psi \rightarrow \gamma\gamma K^+K^-$

¹ Constructive interference between $X(1835)$ and $\eta(1405)/\eta(1475)$ decays to $\gamma\phi$ is assumed. Also see $\eta(1475)$. ABLIKIM 18I reports the inverse as 11.10 ± 3.5 .

² Destructive interference between $X(1835)$ and $\eta(1405)/\eta(1475)$ decays to $\gamma\phi$ is assumed. Also see $\eta(1475)$. ABLIKIM 18I reports the inverse as 7.53 ± 2.49 .

³ Calculated by us from $B(J/\psi \rightarrow \eta(1405)\gamma \rightarrow \phi\gamma\gamma) < 0.82 \times 10^{-4}$ and $B(J/\psi \rightarrow \eta(1405)\gamma \rightarrow \rho^0\gamma\gamma) = (1.07 \pm 0.17 \pm 0.11) \times 10^{-4}$.

 Γ_{11}/Γ_{10}

NODE=M027R14
NODE=M027R14

OCCUR=2

NODE=M027R14;LINKAGE=A

NODE=M027R14;LINKAGE=B

NODE=M027R14;LINKAGE=BA

 $\eta(1405)$ REFERENCES

ABLIKIM	24I	PR D109 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62659
ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58893
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58925
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58322
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55386
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53931
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)	REFID=50764
AMSLER	04B	EPJ C33 23	C. Amstler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51079
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>		REFID=48308
ANISOVICH	00	PL B472 168	A.V. Anisovich <i>et al.</i>		REFID=47429
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)	REFID=47394
ABELE	98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46314
BAI	98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46337
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396

Translated from YAF 60 458.

NODE=M027

BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
AMSLER	95F	PL B358 389	C. AMSLER <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44613
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=44614
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
DUCH	89	ZPHY C45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP	REFID=41016
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) JP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
Also		PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21315
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
FOSTER	68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=21179
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)	REFID=20407

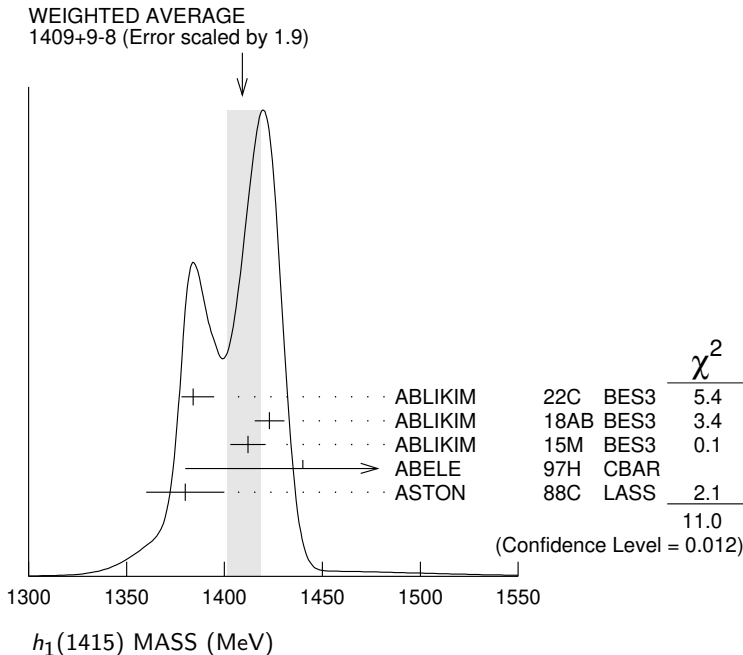
$h_1(1415)$

$$I^G(J^{PC}) = 0^-(1^+ -)$$

$h_1(1415)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1409 \pm \frac{9}{8}$	OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.		
1384 ± 6	$\frac{+9}{-0}$	¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
$1423 \pm 2.1 \pm 7.3$	2.2k	² ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
1412 ± 4	± 8	² ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma \phi(h_1 \rightarrow K^* \bar{K})$
1440 ± 60		ABELE	97H CBAR	$\bar{p} p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
1380 ± 20		ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
² Final states $K^+ K^- \pi^0$ and $K_S^0 K^\pm \pi^\mp$.



$h_1(1415)$ WIDTH

NODE=M109

NODE=M109M

NODE=M109M

NODE=M109M;LINKAGE=B

NODE=M109M;LINKAGE=A

NODE=M109W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
78 ±11	OUR AVERAGE			
66 ±10	$\begin{matrix} +12 \\ -10 \end{matrix}$	¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
90.3 ± 9.8 ± 17.5	2.2k	² ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
84 ±12 ±40		² ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma \phi(h_1 \rightarrow K^* \bar{K})$
170 ±80		ABELE	97H CBAR	$\bar{p} p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
80 ±30		ASTON	88C LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

NODE=M109W

¹ From a partial wave analysis of the systems (γX), with $X \rightarrow \eta' \eta'$, and ($\eta' X$), with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

² Final states $K^+ K^- \pi^0$ and $K_S^0 K^\pm \pi^\mp$.

NODE=M109W;LINKAGE=B

NODE=M109W;LINKAGE=A

$h_1(1415)$ DECAY MODES

NODE=M109215;NODE=M109

Mode

 $\Gamma_1 \quad K \bar{K}^*(892) + \text{c.c.}$

DESIG=1

$h_1(1415)$ REFERENCES

NODE=M109

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18AB	PR D98 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

REFID=61637
REFID=59456
REFID=56778
REFID=45765
REFID=40282

NODE=M006

 $f_1(1420)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M006

$f_1(1420)$ MASS

NODE=M006M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1428.4$^{+1.5}_{-1.3}$	OUR AVERAGE			Error includes scale factor of 1.8. See the ideogram below.
1433.5 ± 1.1	$\begin{matrix} +27.9 \\ -0.7 \end{matrix}$	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1434 ± 5 ± 5		¹ ACHARD	07 L3	$183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
1426 ± 6	711	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1420 ± 14	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1428 ± 4 ± 2	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1426 ± 1		BARBERIS	97C OMEG	$450 pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
1425 ± 8		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1430 ± 4		² ARMSTRONG	92E OMEG	$85,300 \pi^+ p, pp \rightarrow \pi^+ p, pp(K \bar{K} \pi)$
1462 ± 20		³ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
1443 $\begin{matrix} +7 \\ -6 \end{matrix}$ $\begin{matrix} +3 \\ -2 \end{matrix}$	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 10	17	BEHREND	89 CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1442 ± 5 $\begin{matrix} +10 \\ -17 \end{matrix}$	111	BECKER	87 MRK3	$e^+ e^-, \omega K \bar{K} \pi$
1423 ± 4		GIDAL	87B MRK2	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
1417 ± 13	13	AIHARA	86C TPC	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
1422 ± 3		CHAUVAT	84 SPEC	ISR 31.5 pp
1440 ± 10		⁴ BROMBERG	80 SPEC	$100 \pi^- p \rightarrow K \bar{K} \pi X$
1426 ± 6	221	DIONISI	80 HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1420 ± 20		DAHL	67 HBC	$1.6-4.2 \pi^- p$

NODE=M006M2

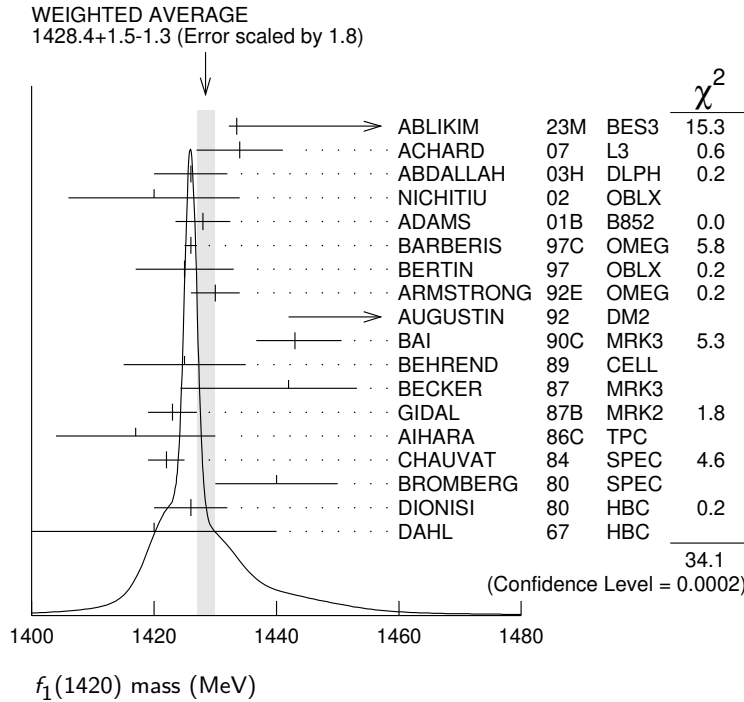
• • • We do not use the following data for averages, fits, limits, etc. • • •

1430.8 ± 0.9		⁵ SOSA	99	SPEC	$pp \rightarrow P_{slow} (K_S^0 K^+ \pi^-) P_{fast}$
1433.4 ± 0.8		⁵ SOSA	99	SPEC	$pp \rightarrow P_{slow} (K_S^0 K^- \pi^+) P_{fast}$
1435 ± 9		PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1429 ± 3	389	ARMSTRONG	89	OMEG	300 $pp \rightarrow K \bar{K} \pi pp$
1425 ± 2	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi) p$
~ 1420		BITYUKOV	84	SPEC	32 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

OCCUR=2

- ¹ From a fit with a width fixed at 55 MeV.
- ² This result supersedes ARMSTRONG 84, ARMSTRONG 89.
- ³ From fit to the $K^*(892)K 1^{++}$ partial wave.
- ⁴ Mass error increased to account for $a_0(980)$ mass cut uncertainties.
- ⁵ No systematic error given.

NODE=M006M2;LINKAGE=CH
 NODE=M006M2;LINKAGE=C
 NODE=M006M2;LINKAGE=B
 NODE=M006M2;LINKAGE=A
 NODE=M006M2;LINKAGE=N1



$f_1(1420)$ WIDTH

NODE=M006W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
56.7 ± 3.3 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
95.9 ± 2.3 ^{+13.6} _{-10.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
51 ± 14	711	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
38 ± 9 ± 6	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C OMEG	450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
45 ± 10		BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
58 ± 10		⁶ ARMSTRONG	92E OMEG	85,300 $\pi^+ p, pp \rightarrow \pi^+ p, pp(K \bar{K} \pi)$
129 ± 41		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
68 ⁺²⁹ ₋₁₈ ± 8 ₋₉	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
42 ± 22	17	BEHREND	89 CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M006W

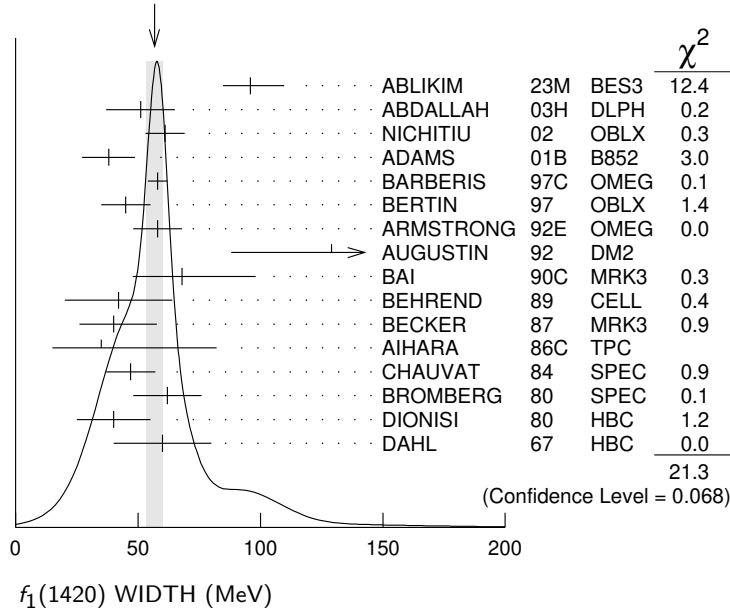
40	$^{+17}_{-13} \pm 5$	111	BECKER	87	MRK3	$e^+ e^- \rightarrow \omega K \bar{K} \pi$
35	$^{+47}_{-20}$	13	AIHARA	86C	TPC	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
47	± 10		CHAUVAT	84	SPEC	ISR 31.5 $p p$
62	± 14		BROMBERG	80	SPEC	100 $\pi^- p \rightarrow K \bar{K} \pi X$
40	± 15	221	DIONISI	80	HBC	4 $\pi^- p \rightarrow K \bar{K} \pi n$
60	± 20		DAHL	67	HBC	1.6-4.2 $\pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
68.7	± 2.9		⁸ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
58.8	± 3.3		⁸ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
90	± 25		PROKOSHKIN	97B	GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58	± 8	389	ARMSTRONG	89	OMEG	300 $p p \rightarrow K \bar{K} \pi p p$
62	± 5	1520	ARMSTRONG	84	OMEG	85 $\pi^+ p, p p \rightarrow (\pi^+, p)(K \bar{K} \pi) p$
~ 50			BITYUKOV	84	SPEC	32 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

OCCUR=2

⁶ This result supersedes ARMSTRONG 84, ARMSTRONG 89.
⁷ From fit to the $K^*(892) K 1^{++}$ partial wave.
⁸ No systematic error given.

NODE=M006W;LINKAGE=C
 NODE=M006W;LINKAGE=B
 NODE=M006W;LINKAGE=N1

WEIGHTED AVERAGE
 56.7 ± 3.3 (Error scaled by 1.3)



$f_1(1420)$ DECAY MODES

NODE=M006215;NODE=M006

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	seen
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_3 $\eta \pi \pi$	possibly seen
Γ_4 $a_0(980) \pi$	
Γ_5 $\pi \pi \rho$	
Γ_6 4π	
Γ_7 $\rho^0 \gamma$	
Γ_8 $\phi \gamma$	seen

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=4
 DESIG=3
 DESIG=6
 DESIG=8
 DESIG=9;OUR EST;→ UNCHECKED ←

$f_1(1420) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M006220

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$ NODE=M006G2
NODE=M006G2

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.4 OUR AVERAGE					
3.2±0.6±0.7		133	9,10 ACHARD	07 L3	183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
3.0±0.9±0.7			11,12 BEHREND	89 CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K\pi$
2.3 ^{+1.0} _{-0.9} ±0.8			HILL	89 JADE	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.3±0.5±0.3			AIHARA	88B TPC	$e^+e^- \rightarrow e^+e^- K^\pm K_S^0 \pi^\mp$
1.6±0.7±0.3			11,13 GIDAL	87B MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95		JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$

⁹ From a fit with a width fixed at 55 MeV.¹⁰ The form factor parameter from the fit is 926 ± 78 MeV.¹¹ Assume a ρ -pole form factor.¹² A ϕ -pole form factor gives considerably smaller widths.¹³ Published value divided by 2.NODE=M006G2;LINKAGE=CH
NODE=M006G2;LINKAGE=CR
NODE=M006G2;LINKAGE=A
NODE=M006G2;LINKAGE=D
NODE=M006G2;LINKAGE=B $f_1(1420)$ BRANCHING RATIOS

NODE=M006225

 $\Gamma(K\bar{K}^*(892) + \text{c.c.}) / \Gamma(K\bar{K}\pi)$ Γ_2 / Γ_1 NODE=M006R1
NODE=M006R1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.76±0.06	BROMBERG	80 SPEC	100 $\pi^- p \rightarrow K\bar{K}\pi X$
0.86±0.12	DIONISI	80 HBC	4 $\pi^- p \rightarrow K\bar{K}\pi n$

 $\Gamma(\pi\pi\rho) / \Gamma(K\bar{K}\pi)$ Γ_5 / Γ_1 NODE=M006R2
NODE=M006R2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	95	CORDEN	78 OMEG	12-15 $\pi^- p$
<2.0		DAHL	67 HBC	1.6-4.2 $\pi^- p$

 $\Gamma(\eta\pi\pi) / \Gamma(K\bar{K}\pi)$ Γ_3 / Γ_1 NODE=M006R3
NODE=M006R3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	ARMSTRONG	91B OMEG	300 $pp \rightarrow pp\eta\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35±0.75		KOPKE	89 MRK3	$J/\psi \rightarrow \omega\eta\pi\pi(K\bar{K}\pi)$
<0.6	90	GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^- \eta\pi^+\pi^-$
<0.5	95	CORDEN	78 OMEG	12-15 $\pi^- p$
1.5 ±0.8		DEFOIX	72 HBC	0.7 $\bar{p}p$

 $\Gamma(a_0(980)\pi) / \Gamma(\eta\pi\pi)$ Γ_4 / Γ_3 NODE=M006R4
NODE=M006R4

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.1	90	PROKOSHKIN	97B GAM4	100 $\pi^- p \rightarrow \eta\pi^0\pi^0 n$
not seen in either mode		ANDO	86 SPEC	8 $\pi^- p$
not seen in either mode		CORDEN	78 OMEG	12-15 $\pi^- p$
0.4±0.2		DEFOIX	72 HBC	0.7 $\bar{p}p \rightarrow 7\pi$

 $\Gamma(4\pi) / \Gamma(K\bar{K}^*(892) + \text{c.c.})$ Γ_6 / Γ_2 NODE=M006R5
NODE=M006R5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.90	95	DIONISI	80 HBC	4 $\pi^- p$

 $\Gamma(K\bar{K}\pi) / [\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980)\pi)]$ $\Gamma_1 / (\Gamma_2 + \Gamma_4)$ NODE=M006R6
NODE=M006R6

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.65±0.27	¹⁴ DIONISI	80 HBC	4 $\pi^- p$

¹⁴ Calculated using $\Gamma(K\bar{K}) / \Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

NODE=M006R6;LINKAGE=C

$\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$ Γ_4/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.042±0.014 OUR AVERAGE				
0.44 ±0.19		ABLIKIM 21U	BES3	$D_s^+ \rightarrow f_1(1420)\pi^+$
0.04 ±0.01 ±0.01		BARBERIS 98C	OMEG	$450 pp \rightarrow p_f f_1(1420)p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.04	68	ARMSTRONG 84	OMEG	$85 \pi^+ \rho$

NODE=M006R7
NODE=M006R7 $\Gamma(4\pi)/\Gamma(K\bar{K}\pi)$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	ARMSTRONG 89G	OMEG	$85 \pi p \rightarrow 4\pi X$

NODE=M006R8
NODE=M006R8 $\Gamma(\rho^0\gamma)/\Gamma_{total}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.08	95	¹⁵ ARMSTRONG 92C	SPEC	$300 pp \rightarrow pp\pi^+\pi^-\gamma$
¹⁵ Using the data on the $\bar{K}K\pi$ mode from ARMSTRONG 89.				

NODE=M006R9
NODE=M006R9

NODE=M006R9;LINKAGE=A

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$ Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	95	BARBERIS 98C	OMEG	$450 pp \rightarrow p_f f_1(1420)p_S$

NODE=M006R10
NODE=M006R10 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.003±0.001±0.001		BARBERIS 98C	OMEG	$450 pp \rightarrow p_f f_1(1420)p_S$

NODE=M006R11
NODE=M006R11 $f_1(1420)$ REFERENCES

NODE=M006

ABLIKIM 23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
ABLIKIM 21U	PR D104 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61155
ACHARD 07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
ABDALLAH 03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
NICHITIU 02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ADAMS 01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
SOSA 99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS 98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
BARBERIS 97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
BERTIN 97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
PROKOSHKIN 97B	PD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky		REFID=45549
Translated from DANS 354 751.				
ARMSTRONG 92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
ARMSTRONG 92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=43173
AUGUSTIN 92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
ARMSTRONG 91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BAI 90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
ARMSTRONG 89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)	REFID=40729
ARMSTRONG 89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
BEHREND 89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
HILL 89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.)	REFID=40741
KOPKE 89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)	REFID=41863
AIHARA 88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BECKER 87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
GIDAL 87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
GIDAL 87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40224
AIHARA 86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=21326
ANDO 86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)	REFID=20891
ARMSTRONG 84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20929
BITYUKOV 84	SJNP 39 735	S. Bitjukov <i>et al.</i>	(SERP)	REFID=45856
Translated from YAF 39 1165.				
CHAUVAT 84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
JENNI 83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BROMBERG 80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)	REFID=20922
DIONISI 80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+)	REFID=20924
CORDEN 78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20452
DEFOIX 72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DAHL 67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321
Also	PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)	REFID=21291

$\omega(1420)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

See also the $\omega(1650)$ particle listing.

NODE=M125

NODE=M125

NODE=M125M

NODE=M125M

→ UNCHECKED ←

 $\omega(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1410± 60 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1418± 30± 10	824	¹ AKHMETSHIN 17A	CMD3	1.4-2.0 $e^+e^- \rightarrow \omega\eta$
1470± 50	13.1k	² AULCHENKO 15A	SND	1.05-1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1382± 23± 70		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1350± 20± 20		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1400± 50± 130	1.2M	³ ACHASOV 03D	RVUE	0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1450± 10		⁴ HENNER 02	RVUE	1.2-2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1373± 70	177	⁵ AKHMETSHIN 00D	CMD2	1.2-1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
1370± 25	5095	ANISOVICH 00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
1400 ⁺¹⁰⁰ ₋₂₀₀		⁶ ACHASOV 98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
~ 1400		⁷ ACHASOV 98H	RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
~ 1460		⁸ ACHASOV 98H	RVUE	$e^+e^- \rightarrow K^+K^-$
1440± 70		⁹ CLEGG 94	RVUE	
1419± 31	315	¹⁰ ANTONELLI 92	DM2	1.34-2.4 $e^+e^- \rightarrow \rho\pi$
¹ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.				
² From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.				
³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.				
⁴ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.				
⁵ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.				
⁶ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.				
⁷ Using the data from ANTONELLI 92.				
⁸ Using the data from IVANOV 81 and BISELLO 88B.				
⁹ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.				
¹⁰ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.				

NODE=M125M;LINKAGE=F

NODE=M125M;LINKAGE=E

NODE=M125M;LINKAGE=VH

NODE=M125M;LINKAGE=AB

NODE=M125M;LINKAGE=KL

NODE=M125M;LINKAGE=L1

NODE=M125M;LINKAGE=L2

NODE=M125M;LINKAGE=L3

NODE=M125M;LINKAGE=AD

NODE=M125M;LINKAGE=B

 $\omega(1420)$ WIDTH

NODE=M125W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
290± 190 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
440± 125	267	¹ ACHASOV 20B	SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
104± 35± 10	824	² AKHMETSHIN 17A	CMD3	1.4-2.0 $e^+e^- \rightarrow \omega\eta$
880± 170	13.1k	³ AULCHENKO 15A	SND	1.05-1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
480± 180		⁴ ACHASOV 10D	SND	1.075-2.0 $e^+e^- \rightarrow \pi^0\gamma$
130± 50± 100		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
450± 70± 70		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
870 ⁺⁵⁰⁰ ₋₃₀₀ ± 450	1.2M	⁵ ACHASOV 03D	RVUE	0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199± 15		⁶ HENNER 02	RVUE	1.2-2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188± 45	177	⁷ AKHMETSHIN 00D	CMD2	1.2-1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
360 ⁺¹⁰⁰ ₋₆₀	5095	ANISOVICH 00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
240± 70		⁸ CLEGG 94	RVUE	
174± 59	315	⁹ ANTONELLI 92	DM2	1.34-2.4 $e^+e^- \rightarrow \rho\pi$

NODE=M125W

→ UNCHECKED ←

- ¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV.
- ² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.
- ³ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.
- ⁴ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.
- ⁵ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ⁶ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ⁷ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.
- ⁸ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ⁹ From a fit to two Breit-Wigner functions interfering between them and with the ω,ϕ tails with fixed (+,-,+) phases.

NODE=M125W;LINKAGE=H

NODE=M125W;LINKAGE=F

NODE=M125W;LINKAGE=E

NODE=M125W;LINKAGE=G

NODE=M125W;LINKAGE=VH

NODE=M125W;LINKAGE=AB

NODE=M125W;LINKAGE=KL

NODE=M125W;LINKAGE=AD

NODE=M125W;LINKAGE=B

 $\omega(1420)$ DECAY MODES

NODE=M125215;NODE=M125

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	
Γ_4 $b_1(1235)\pi$	seen
Γ_5 e^+e^-	seen
Γ_6 $\pi^0\gamma$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=6

 $\omega(1420)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M125230

 $\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_5/\Gamma$ NODE=M125G3
NODE=M125G3

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.73 ± 0.08	13.1k	¹ AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.82 ± 0.05 ± 0.06		AUBERT,B	04N	BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
0.65 ± 0.13 ± 0.21	1.2M	^{2,3} ACHASOV	03D	RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.625 ± 0.160		^{4,5} CLEGG	94	RVUE
0.466 ± 0.178		^{6,7} ANTONELLI 92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

NODE=M125G3;LINKAGE=A

NODE=M125G;LINKAGE=AW

NODE=M125G;LINKAGE=VH

NODE=M125G;LINKAGE=AD

NODE=M125G;LINKAGE=SE

NODE=M125G;LINKAGE=A

NODE=M125G;LINKAGE=ES

- ¹ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

² Calculated by us from the cross section at the peak.

- ³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁵ From the partial and leptonic width given by the authors.

⁶ From a fit to two Breit-Wigner functions interfering between them and with the ω,ϕ tails with fixed (+,-,+) phases.

⁷ From the product of the leptonic width and partial branching ratio given by the authors.

 $\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma \times \Gamma_5/\Gamma$ NODE=M125G4
NODE=M125G4

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
19.7 ± 5.7	AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1.9 ± 1.9	¹ AKHMETSHIN 00D	CMD2	1.2–2.4 $e^+e^- \rightarrow \omega\pi^+\pi^-$

- ¹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

NODE=M125G;LINKAGE=KL

$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.5 ± 0.6	267	¹ ACHASOV	20B SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
$2.1^{+1.0}_{-0.8}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
$5.0 \pm 2.6 \pm 0.3$	824	² AKHMETSHIN	17A CMD3	$1.4-2.0 e^+e^- \rightarrow \omega\eta$
$1.6^{+0.9}_{-0.7}$	898	³ ACHASOV	16B SND	$1.34-2.00 e^+e^- \rightarrow \omega\eta$

NODE=M125G6
 NODE=M125G6

¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in $(3.0 \pm 1.6) \times 10^{-8}$ measurement.

NODE=M125G6;LINKAGE=C

² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating. From an alternative fit $\Gamma(\omega(1420) \rightarrow \omega\eta)/\Gamma_{\text{total}} \times \Gamma(\omega(1420) \rightarrow e^+e^-) = 5.3 \pm 1.6$ eV.

NODE=M125G6;LINKAGE=B

³ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass and the width of $\omega(1420)$ are fixed to the 2014 edition (PDG 14) of this review.

NODE=M125G6;LINKAGE=A

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.23 ± 0.14	¹ ACHASOV	10D SND	$1.075-2.0 e^+e^- \rightarrow \pi^0\gamma$
$2.03^{+0.70}_{-0.75}$	² AKHMETSHIN	05 CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$

NODE=M125G5
 NODE=M125G5

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

NODE=M125G5;LINKAGE=A

² Using 1420 MeV and 220 MeV for the $\omega(1420)$ mass and width.

NODE=M125G5;LINKAGE=AK

 $\omega(1420)$ BRANCHING RATIOS

NODE=M125225

 $\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.301 ± 0.029 possibly seen	¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
	AKHMETSHIN	00D CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$

NODE=M125R2
 NODE=M125R2

 $\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$ Γ_2/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.60 ± 0.16	5095	ANISOVICH	00H SPEC	$0.0 p\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$

NODE=M125R1
 NODE=M125R1

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
seen	ACHASOV	20A SND	$1.15-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.699 ± 0.029	¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R3
 NODE=M125R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 6.6	1.2M	^{2,3} ACHASOV	03D RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
23 ± 1		¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R4
 NODE=M125R4

¹ Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M125R;LINKAGE=AC

² Calculated by us from the cross section at the peak.

NODE=M125R;LINKAGE=AW

³ Assuming that the $\omega(1420)$ decays into $\rho\pi$ only.

NODE=M125R;LINKAGE=GS

$\omega(1420)$ REFERENCES

Author	Year	Journal	Volume	Page	Collaboration	REFID
ACHASOV	20A	EPJ	C80	993	M.N. Achasov <i>et al.</i> (SND Collab.)	60923
ACHASOV	20B	EPJ	C80	1008	M.N. Achasov <i>et al.</i> (SND Collab.)	60924
ACHASOV	19	PR	D99	112004	M.N. Achasov <i>et al.</i> (SND Collab.)	59887
PDG	18	PR	D98	030001	M. Tanabashi <i>et al.</i> (PDG Collab.)	59304
AKHMETSHIN	17A	PL	B773	150	R.R. Akhmetshin <i>et al.</i> (CMD-3 Collab.)	58239
ACHASOV	16B	PR	D94	092002	M.N. Achasov <i>et al.</i> (SND Collab.)	57537
AULCHENKO	15A	JETP	121	27	V.M. Aulchenko <i>et al.</i> (SND Collab.)	56843
Translated from ZETF 148 34.						
PDG	14	CP	C38	070001	K. Olive <i>et al.</i> (PDG Collab.)	55687
ACHASOV	10D	PR	D98	112001	M.N. Achasov <i>et al.</i> (SND Collab.)	59494
AUBERT	07AU	PR	D76	092005	B. Aubert <i>et al.</i> (BABAR Collab.)	52049
AKHMETSHIN	05	PL	B605	26	R.R. Akhmetshin <i>et al.</i> (Novosibirsk CMD-2 Collab.)	50330
AUBERT,B	04N	PR	D70	072004	B. Aubert <i>et al.</i> (BABAR Collab.)	50184
ACHASOV	03D	PR	D68	052006	M.N. Achasov <i>et al.</i> (Novosibirsk SND Collab.)	49577
ACHASOV	02E	PR	D66	032001	M.N. Achasov <i>et al.</i> (Novosibirsk SND Collab.)	48815
HENNER	02	EPJ	C26	3	V.K. Henner <i>et al.</i> (Novosibirsk SND Collab.)	49177
ACHASOV	01E	PR	D63	072002	M.N. Achasov <i>et al.</i> (Novosibirsk SND Collab.)	48311
AKHMETSHIN	00D	PL	B489	125	R.R. Akhmetshin <i>et al.</i> (Novosibirsk CMD-2 Collab.)	47935
ANISOVICH	00H	PL	B485	341	A.V. Anisovich <i>et al.</i> (Novosibirsk SND Collab.)	47948
ACHASOV	99E	PL	B462	365	M.N. Achasov <i>et al.</i> (Novosibirsk SND Collab.)	47391
ACHASOV	98H	PR	D57	4334	N.N. Achasov, A.A. Kozhevnikov (Novosibirsk SND Collab.)	46323
CLEGG	94	ZPHY	C62	455	A.B. Clegg, A. Donnachie (LANC, MCHS)	44081
ANTONELLI	92	ZPHY	C56	15	A. Antonelli <i>et al.</i> (DM2 Collab.)	43168
DOLINSKY	91	PRPL	202	99	S.I. Dolinsky <i>et al.</i> (NOVO)	41369
BISELLO	88B	ZPHY	C39	13	D. Bisello <i>et al.</i> (PADO, CLER, FRAS+)	40581
BARKOV	87	JETPL	46	164	L.M. Barkov <i>et al.</i> (NOVO)	40280
Translated from ZETFP 46 132.						
CORDIER	81	PL	106B	155	A. Cordier <i>et al.</i> (ORSAY)	21586
IVANOV	81	PL	107B	297	P.M. Ivanov <i>et al.</i> (NOVO)	20553

NODE=M125

 $f_2(1430)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry lists nearby peaks observed in the D wave of the $K\bar{K}$ and $\pi^+\pi^-$ systems. Needs confirmation.

NODE=M066

 $f_2(1430)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
≈ 1430 OUR ESTIMATE			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$1440 \pm 11 \pm 3$	LEES	21A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
1453 ± 4	¹ VLADIMIRSK...01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1421 ± 5	AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
1480 ± 50	AKESSON	86	SPEC $pp \rightarrow pp \pi^+ \pi^-$
1436^{+26}_{-16}	DAUM	84	CNTR $17-18 \pi^- p \rightarrow K^+ K^- n$
1412 ± 3	DAUM	84	CNTR $63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
1439^{+5}_{-6}	² BEUSCH	67	OSPK $5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
¹ $J^{PC} = 0^{++}$ or 2^{++} .			
² Not seen by WETZEL 76.			

NODE=M066M1

NODE=M066M1

→ UNCHECKED ←

OCCUR=2

NODE=M066M;LINKAGE=AC

NODE=M066M;LINKAGE=C

 $f_2(1430)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$46 \pm 15 \pm 5$	LEES	21A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
13 ± 5	³ VLADIMIRSK...01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
30 ± 9	AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
150 ± 50	AKESSON	86	SPEC $pp \rightarrow pp \pi^+ \pi^-$
81^{+56}_{-29}	DAUM	84	CNTR $17-18 \pi^- p \rightarrow K^+ K^- n$
14 ± 6	DAUM	84	CNTR $63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
43^{+17}_{-18}	⁴ BEUSCH	67	OSPK $5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
³ $J^{PC} = 0^{++}$ or 2^{++} .			
⁴ Not seen by WETZEL 76.			

NODE=M066W1

NODE=M066W1

OCCUR=2

NODE=M066W;LINKAGE=AC

NODE=M066W;LINKAGE=C

$f_2(1430)$ DECAY MODES

NODE=M066215;NODE=M066

Mode	
Γ_1	$K\bar{K}$
Γ_2	$\pi\pi$

DESIG=1

DESIG=2

 $f_2(1430)$ REFERENCES

NODE=M066

LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
VLADIMIRSK...	01	PAN 64 1895 Translated from YAF 64 1979.	V.V. Vladimisky <i>et al.</i>	
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i>	(Axial Field Spec. Collab.)
DAUM	84	ZPHY C23 339	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)
BEUSCH	67	PL 25B 357	W. Beusch <i>et al.</i>	(ETH, CERN)

REFID=61442

REFID=48571

REFID=40268

REFID=21123

REFID=21372

REFID=20362

REFID=20320

NODE=M149

$a_0(1450)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M149

 $a_0(1450)$ T-MATRIX POLE \sqrt{s}

NODE=M149PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M149PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1290–1500) – i (30–140) OUR ESTIMATE			
$(1302.1 \pm 1.1 \pm 3.9) - i$ (56.2 \pm 0.7 \pm 1.7)	¹ ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1515 \pm 30) - i$ (115 \pm 18)	ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1432 \pm 13 \pm 25) - i$ (98 \pm 5 \pm 5)	² BUGG	08A	RVUE $\bar{p}p$
$(1441^{+40}_{-15}) - i$ (55 \pm 7)	³ BAKER	03	SPEC $\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
$(1303 \pm 16) - i$ (46 \pm 8)	⁴ BARGIOTTI	03	OBLX $\bar{p}p$
$(1296 \pm 10) - i$ (41 \pm 11)	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$(1565 \pm 30) - i$ (146 \pm 20)	ANISOVICH	98B	RVUE Compilation
$(1470 \pm 25) - i$ (132 \pm 15)	⁵ AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta \eta, \pi^0 \pi^0 \eta$

NODE=M149PP

→ UNCHECKED ←

¹ T-matrix pole, 2 poles, 2 channels ($\pi\eta, K\bar{K}$).² Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.³ From the pole position of a fitted Breit-Wigner amplitude.⁴ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0,$ and $K^\pm K_S^0 \pi^\mp$.⁵ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

NODE=M149PP;LINKAGE=A

NODE=M149PP;LINKAGE=G

NODE=M149PP;LINKAGE=C

NODE=M149PP;LINKAGE=D

NODE=M149PP;LINKAGE=F

 $a_0(1450)$ MASS

NODE=M149M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1439 \pm 34 OUR AVERAGE		Error includes scale factor of 1.8.		
1480 \pm 30		ABELE	98	CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
1410 \pm 25		ETKIN	82C	MPS $23 \pi^- p \rightarrow n 2K_S^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1458 \pm 14 \pm 15	190k	¹ AAJ	16N	LHCB $D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
$1316.8^{+0.7+24.7}_{-1.0-4.6}$		² UEHARA	09A	BELL $\gamma\gamma \rightarrow \pi^0 \eta$
1477 \pm 10	80k	³ UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta \eta \pi^0$
1290 \pm 10		⁴ BERTIN	98B	OBLX $0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
1450 \pm 40		AMSLER	94D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
\sim 1300		MARTIN	78	SPEC $10 K^\pm p \rightarrow K_S^0 \pi p$
1255 \pm 5		⁵ CASON	76	

NODE=M149M

- ¹ Using a model with Gaussian constraints to the PDG averaged values.
² May be a different state.
³ Statistical error only.
⁴ Not confirmed by BUGG 08A.
⁵ Isospin 0 not excluded.

NODE=M149M;LINKAGE=A
 NODE=M149M;LINKAGE=UE
 NODE=M149M;LINKAGE=ST
 NODE=M149M;LINKAGE=BE
 NODE=M149M;LINKAGE=CC

$a_0(1450)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
258 ± 14	OUR AVERAGE			
265 ± 15		ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
230 ± 30		ETKIN	82C MPS	23 $\pi^- p \rightarrow n 2K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
282 ± 12 ± 13	190k	¹ AAIJ	16N LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
65.0 ⁺ ₋ 2.1+99.1 5.4-32.6		² UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
267 ± 11	80k	³ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
80 ± 5		⁴ BERTIN	98B OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S \pi^\mp$
270 ± 40		AMSLER	94D CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
~ 250		MARTIN	78 SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
79 ± 10		⁵ CASON	76	

NODE=M149W

NODE=M149W

- ¹ Using a model with Gaussian constraints to the PDG averaged values.
² May be a different state.
³ Statistical error only.
⁴ Not confirmed by BUGG 08A.
⁵ Isospin 0 not excluded.

NODE=M149W;LINKAGE=A
 NODE=M149W;LINKAGE=UE
 NODE=M149W;LINKAGE=ST
 NODE=M149W;LINKAGE=BE
 NODE=M149W;LINKAGE=CC

$a_0(1450)$ DECAY MODES

Branching fractions are given relative to the one **DEFINED AS 1**.

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi \eta$	0.093 ± 0.020
Γ_2 $\pi \eta'(958)$	0.033 ± 0.017
Γ_3 $K \bar{K}$	0.082 ± 0.028
Γ_4 $\omega \pi \pi$	DEFINED AS 1
Γ_5 $a_0(980) \pi \pi$	seen
Γ_6 $\gamma \gamma$	seen

NODE=M149215;NODE=M149

NODE=M149

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$a_0(1450)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_1 \Gamma_6 / \Gamma$
432 ± 6 ⁺ ₋ 1073 256	¹ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$	

NODE=M149225

NODE=M149G01
 NODE=M149G01

- ¹ May be a different state.

NODE=M149G01;LINKAGE=UE

$a_0(1450)$ BRANCHING RATIOS

$\Gamma(\pi\eta'(958))/\Gamma(\pi\eta)$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
0.35 ± 0.16	¹ ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.43 ± 0.19	ABELE	97C CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta'$	

NODE=M149220

NODE=M149R1
 NODE=M149R1

- ¹ Using $\pi^0 \eta$ from AMSLER 94D.

NODE=M149R1;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma(\pi\eta)$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
0.88 ± 0.23	¹ ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.887 ± 0.041 ± 0.97	² ALBRECHT	20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$	

NODE=M149R2
 NODE=M149R2

- ¹ Using $\pi^0 \eta$ from AMSLER 94D.
² Residues from T-matrix pole, 2 poles, 2 channels ($\pi\eta, K\bar{K}$).

NODE=M149R2;LINKAGE=A
 NODE=M149R2;LINKAGE=B

$\Gamma(\omega\pi\pi)/\Gamma(\pi\eta)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
10.7±2.3	35280	¹ BAKER	03 SPEC	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$	

¹ Using results on $\bar{p}p \rightarrow a_0(1450)^0\pi^0$, $a_0(1450) \rightarrow \eta\pi^0$ from ABELE 96C and assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M149R3
NODE=M149R3

NODE=M149R;LINKAGE=PP

 $\Gamma(a_0(980)\pi\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
seen	BUGG	08A RVUE	$\bar{p}p$	

NODE=M149R01
NODE=M149R01

 $\Gamma(a_0(980)\pi\pi)/\Gamma(\pi\eta)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_5/Γ_1
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• • • We do not use the following data for averages, fits, limits, etc. • • •

≤ 4.3 ANISOVICH 01 RVUE 0 $\bar{p}p \rightarrow \eta 2\pi^+ 2\pi^-$

NODE=M149R02
NODE=M149R02

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
seen	¹ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0\eta$	

¹ May be a different state.

NODE=M149R03
NODE=M149R03

NODE=M149R03;LINKAGE=UE

 $a_0(1450)$ REFERENCES

ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
AAIJ 16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ANISOVICH 09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA 09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
BUGG 08A	PR D78 074023	D.V. Bugg	(LOQM)	REFID=52578
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
BAKER 03	PL B563 140	C.A. Baker <i>et al.</i>		REFID=49414
BARGIOTTI 03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
AMSLER 02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ANISOVICH 01	NP A690 567	A.V. Anisovich <i>et al.</i>		REFID=48308
ABELE 98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45863
ANISOVICH 98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
	Translated from UFN 168 481.			
BERTIN 98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
ABELE 97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45531
ABELE 96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45076
AMSLER 95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER 95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44440
AMSLER 95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
AMSLER 94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.) IGJPC	REFID=44093
BUGG 94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
ETKIN 82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20391
MARTIN 78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=22446
CASON 76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=21064

NODE=M149

$\rho(1450)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

NODE=M105

 $\rho(1450)$ MASS

NODE=M105205

 $\rho(1450)$ MASS

VALUE (MeV)

DOCUMENT ID

1465±25 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105M0

NODE=M105M0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1506±11	13.4k	¹ GRIBANOV 20	CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1500±10	7.4k	² ACHASOV 18	SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1497±14		³ AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1421±15		⁴ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1470±20		ANTONELLI 88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1446±10		FUKUI 88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M105M1

NODE=M105M1

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

NODE=M105M1;LINKAGE=B

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M105M1;LINKAGE=A

³ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

NODE=M105M;LINKAGE=SW

⁴ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105M1;LINKAGE=KL

 $\omega\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1510±7	10.2k	¹ ACHASOV 16D	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1544±22 ⁺¹¹ ₋₄₆	821	² MATVIENKO 15	BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
1491±19	7815	³ ACHASOV 13	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1582±17±25	2382	⁴ AKHMETSHIN 03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1349±25 ⁺¹⁰ ₋₅	341	⁵ ALEXANDER 01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
1523±10		⁶ EDWARDS 00A	CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$
1463±25		⁷ CLEGG 94	RVUE	
1250		⁸ ASTON 80C	OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$
1290±40		⁸ BARBER 80C	SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$

NODE=M105M3

NODE=M105M3

OCCUR=2

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

NODE=M105M3;LINKAGE=D

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

NODE=M105M3;LINKAGE=C

³ From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M105M3;LINKAGE=AC

⁴ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

NODE=M105M3;LINKAGE=HK

⁵ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

NODE=M105M3;LINKAGE=3Z

⁶ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

NODE=M105M;LINKAGE=E1

⁷ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105M3;LINKAGE=B

⁸ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105M3;LINKAGE=A

 4π MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1435±40		ABELE 01B	CBAR	0.0 $\bar{p}n \rightarrow 2\pi^- 2\pi^0\pi^+$
1350±50		ACHASOV 97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1449±4		¹ ARMSTRONG 89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$

NODE=M105M6

NODE=M105M6

¹ Not clear whether this observation has $l=1$ or 0.

NODE=M105M6;LINKAGE=A

$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1226.22 ± 24.76	34M	1 IGNATOV	24 CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
1326.35 ± 3.46		2 BARTOS	17 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1342.31 ± 46.62		3 BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1373.83 ± 11.37		4 BARTOS	17A RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1429 ± 41	20k	5 LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
1350 ± 20	${}^{+20}_{-30}$ 63.5k	6 ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
1493 ± 15		7 LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
1446 ± 7	± 28 5.4M	8,9 FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1328 ± 15		10 SCHAEEL	05c ALEP	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1406 ± 15	87k	8,11 ANDERSON	00A CLE2	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
~ 1368		12 ABELE	99c CBAR	$0.0 \bar{p}d \rightarrow \pi^+\pi^-\pi^-p$
1348 ± 33		BERTIN	98 OBLX	$0.05-0.405 \bar{n}p \rightarrow$ $2\pi^+\pi^-\pi^0$
1411 ± 14		13 ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1370 ${}^{+90}_{-70}$		ACHASOV	97 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1359 ± 40		11 BERTIN	97c OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1282 ± 37		BERTIN	97D OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
1424 ± 25		BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1265.5 ± 75.3		DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1292 ± 17		14 KURDADZE	83 OLYA	$0.64-1.4 e^+e^- \rightarrow$ $\pi^+\pi^-$

NODE=M105M5
NODE=M105M5

OCCUR=2

OCCUR=2

¹ From a fit of the pion form factor using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. The fit uses also data from CMD-2 and DM2 experiments. Systematic errors not estimated.

² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

⁴ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.

⁵ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.

⁶ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho - \omega$ interference.

⁷ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁸ From the GOUNARIS 68 parametrization of the pion form factor.

⁹ $|F_\pi(0)|^2$ fixed to 1.

¹⁰ From the combined fit of the τ^- data from ANDERSON 00A and SCHAEEL 05c and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.

¹¹ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

¹² $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

¹³ T-matrix pole.

¹⁴ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105M5;LINKAGE=G

NODE=M105M5;LINKAGE=D

NODE=M105M5;LINKAGE=E

NODE=M105M5;LINKAGE=F

NODE=M105M5;LINKAGE=B

NODE=M105M5;LINKAGE=AB

NODE=M105M5;LINKAGE=LE

NODE=M105M;LINKAGE=1K

NODE=M105M5;LINKAGE=FU

NODE=M105M5;LINKAGE=SC

NODE=M105M5;LINKAGE=A

NODE=M105M5;LINKAGE=C5

NODE=M105M5;LINKAGE=QQ

NODE=M105M5;LINKAGE=KD

NODE=M105M7
NODE=M105M7 **$K\bar{K}$ MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1208 ± 8 ± 9	190k	1 AAJ	16N LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1422.8 ± 6.5	27k	2 ABELE	99D CBAR	\pm	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Using the GOUNARIS 68 parameterization with fixed width.

² K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105M7;LINKAGE=A

NODE=M105M7;LINKAGE=AN

 $K\bar{K}^*(892) + c.c.$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1505 ± 19 ± 7	AUBERT	08s BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105M8
NODE=M105M8 **$m_{\rho(1450)^0} = m_{\rho(1450)^\pm}$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-31.53 ± 47.99	1 BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$

NODE=M105DM
NODE=M105DM

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M105DM;LINKAGE=A

$\rho(1450)$ WIDTH

NODE=M105210

$\rho(1450)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M105W0

NODE=M105W0

400± 60 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

480±180	¹ ACHASOV	10D	SND	1.075–2.0 $e^+e^- \rightarrow \pi^0\gamma$
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NODE=M105W0;LINKAGE=A

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

$\eta\rho^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M105W1

NODE=M105W1

• • • We do not use the following data for averages, fits, limits, etc. • • •

321±27	13.4k	¹ GRIBANOV	20	CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
280±20	7.4k	² ACHASOV	18	SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
226±44		³ AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
211±31		⁴ AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
230±30		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
60±15		FUKUI	88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M105W1;LINKAGE=B

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

NODE=M105W1;LINKAGE=A

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

³ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

NODE=M105W;LINKAGE=SW

⁴ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105W1;LINKAGE=KL

$\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M105W3

NODE=M105W3

• • • We do not use the following data for averages, fits, limits, etc. • • •

440± 40	10.2k	¹ ACHASOV	16D	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
303 ⁺³¹⁺⁶⁹ ₋₅₂₋₇	821	² MATVIENKO	15	BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
429± 42±10	2382	³ AKHMETSHIN	03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
547± 86 ⁺⁴⁶ ₋₄₅	341	⁴ ALEXANDER	01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
400± 35		⁵ EDWARDS	00A	CLE2	$\tau^- \rightarrow \omega\pi^-\nu_\tau$
311± 62		⁶ CLEGG	94	RVUE	
300		⁷ ASTON	80C	OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$
320±100		⁷ BARBER	80C	SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$

OCCUR=3

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

NODE=M105W3;LINKAGE=D

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

NODE=M105W3;LINKAGE=C

³ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

NODE=M105W3;LINKAGE=HK

⁴ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

NODE=M105W3;LINKAGE=3Z

⁵ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

NODE=M105W;LINKAGE=E1

⁶ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105W3;LINKAGE=B

⁷ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105W3;LINKAGE=A

4 π MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M105W66

NODE=M105W66

• • • We do not use the following data for averages, fits, limits, etc. • • •

325±100	ABELE	01B	CBAR	0.0 $\bar{p}n \rightarrow 2\pi^- 2\pi^0\pi^+$
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$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
272.97 ± 45.53	34M	1 IGNATOV	24 CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
324.13 ± 12.01		2 BARTOS	17 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
492.17 ± 138.38		3 BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
340.87 ± 23.84		4 BARTOS	17A RVUE	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
576 ± 29	20k	5 LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
460 ± 30	$\begin{matrix} +40 \\ -45 \end{matrix}$ 63.5k	6 ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-\rho$
427 ± 31		7 LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
434 ± 16	±60 5.4M	8,9 FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
468 ± 41		10 SCHAEEL	05C ALEP	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
455 ± 41	87k	8,11 ANDERSON	00A CLE2	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
~ 374		12 ABELE	99C CBAR	$0.0 \bar{p}d \rightarrow \pi^+\pi^-\pi^-p$
275 ± 10		BERTIN	98 OBLX	$0.05-0.405 \bar{n}p \rightarrow \pi^+\pi^+\pi^-$
343 ± 20		13 ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		11 BERTIN	97C OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
236 ± 36		BERTIN	97D OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
269 ± 31		BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
391 ± 70		DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
218 ± 46		14 KURDADZE	83 OLYA	$0.64-1.4 e^+e^- \rightarrow \pi^+\pi^-$

NODE=M105W5
 NODE=M105W5

OCCUR=2

- 1 From a fit of the pion form factor using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. The fit uses also data from CMD-2 and DM2 experiments. Systematic errors not estimated.
- 2 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.
- 3 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.
- 4 Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.
- 5 From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.
- 6 Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
- 7 Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
- 8 From the GOUNARIS 68 parametrization of the pion form factor.
- 9 $|F_\pi(0)|^2$ fixed to 1.
- 10 From the combined fit of the τ^- data from ANDERSON 00A and SCHAEEL 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.
- 11 $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.
- 12 $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.
- 13 T-matrix pole.
- 14 Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105W5;LINKAGE=F

NODE=M105W5;LINKAGE=C

NODE=M105W5;LINKAGE=D

NODE=M105W5;LINKAGE=E

NODE=M105W5;LINKAGE=B

NODE=M105W5;LINKAGE=AB

NODE=M105W5;LINKAGE=LE

NODE=M105W;LINKAGE=1K

NODE=M105W5;LINKAGE=FU

NODE=M105W5;LINKAGE=SC

NODE=M105W5;LINKAGE=A

NODE=M105W5;LINKAGE=C5

NODE=M105W5;LINKAGE=QQ

NODE=M105W5;LINKAGE=KD

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
410 ± 19 ± 35	190k	1 AAIJ	16N LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
146.5 ± 10.5	27k	2 ABELE	99D CBAR	±	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$

1 Using the GOUNARIS 68 parameterization with fixed mass.

2 K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105W7
 NODE=M105W7

NODE=M105W7;LINKAGE=A

NODE=M105W7;LINKAGE=AN

 $K\bar{K}^*(892) + c.c.$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
418 ± 25 ± 4	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105W8
 NODE=M105W8

 $\Gamma_{\rho(1450)^0} - \Gamma_{\rho(1450)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
151.30 ± 140.42	1 BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$

NODE=M105DW
 NODE=M105DW

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M105DW;LINKAGE=A

 $\rho(1450)$ DECAY MODES

NODE=M105215;NODE=M105

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\pi^+\pi^-$	seen
Γ_3 4π	seen
Γ_4 $\omega\pi$	
Γ_5 $a_1(1260)\pi$	
Γ_6 $h_1(1170)\pi$	
Γ_7 $\pi(1300)\pi$	
Γ_8 $\rho\rho$	
Γ_9 $\rho(\pi\pi)$ S-wave	
Γ_{10} e^+e^-	seen
Γ_{11} $\eta\rho$	seen
Γ_{12} $a_2(1320)\pi$	not seen
Γ_{13} $K\bar{K}$	seen
Γ_{14} K^+K^-	seen
Γ_{15} $K\bar{K}^*(892)+c.c.$	possibly seen
Γ_{16} $\pi^0\gamma$	seen
Γ_{17} $\eta\gamma$	seen
Γ_{18} $f_0(500)\gamma$	not seen
Γ_{19} $f_0(980)\gamma$	not seen
Γ_{20} $f_0(1370)\gamma$	not seen
Γ_{21} $f_2(1270)\gamma$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=20;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=10
DESIG=11
DESIG=12
DESIG=13
DESIG=14
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=21;OUR EVAL;→ UNCHECKED ←
DESIG=15;OUR EST;→ UNCHECKED ←
DESIG=23;OUR EST;→ UNCHECKED ←
DESIG=9
DESIG=16;OUR EST;→ UNCHECKED ←
DESIG=17;OUR EST;→ UNCHECKED ←
DESIG=18;OUR EST;→ UNCHECKED ←
DESIG=19;OUR EST;→ UNCHECKED ←

 $\rho(1450) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M105220

$\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_{10}/\Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M105G3
NODE=M105G3

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.12	¹ DIEKMAN	88	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
$0.027^{+0.015}_{-0.010}$	² KURDADZE	83	OLYA $0.64-1.4 e^+e^- \rightarrow \pi^+\pi^-$

¹ Using total width = 235 MeV.

² Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105G3;LINKAGE=B
NODE=M105G3;LINKAGE=KD

$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{11}\Gamma_{10}/\Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M105G4
NODE=M105G4

• • • We do not use the following data for averages, fits, limits, etc. • • •

$335 \pm 27 \pm 20$	13.4k	¹ GRIBANOV	20	CMD3 $1.1-2.0 e^+e^- \rightarrow \eta\pi^+\pi^-$
$210 \pm 24 \pm 10$		² LEES	18	BABR $e^+e^- \rightarrow \eta\pi^+\pi^-$
74 ± 20		³ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19		ANTONELLI	88	DM2 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

² Includes non-resonant contribution. The selected fit model includes three ρ excited states. Model uncertainty is 20%.

³ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105G4;LINKAGE=B

NODE=M105G4;LINKAGE=A

NODE=M105G4;LINKAGE=KL

$\Gamma(K\bar{K}^*(892)+c.c.) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{15}\Gamma_{10}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M105G8
NODE=M105G8

• • • We do not use the following data for averages, fits, limits, etc. • • •

$127 \pm 15 \pm 6$	AUBERT	08S	BABR $10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$
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$$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{17}\Gamma_{10}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M105G6
NODE=M105G6

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16.4	¹ AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
2.2±0.5±0.3	² AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

¹ From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.

NODE=M105G6;LINKAGE=AK

² Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$. Recalculated by us using width of 226 MeV.

NODE=M105G;LINKAGE=SW

$$\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M105230

$$\Gamma(\omega\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_4/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M105R05
NODE=M105R05

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.1±0.4	10.2k	¹ ACHASOV	16D SND	1.05-2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
5.3±0.4	7815	² ACHASOV	13 SND	1.05-2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=3

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

NODE=M105R05;LINKAGE=A

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M105R05;LINKAGE=AC

$$\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{11}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M105R00
NODE=M105R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.3±0.3	7.4k	¹ ACHASOV	18 SND	1.22-2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
4.3 ^{+1.1} _{-0.9} ±0.2	4.9k	² AULCHENKO	15 SND	1.22-2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M105R00;LINKAGE=B

² From a fit to the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta\rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R00;LINKAGE=A

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{16}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-9})	DOCUMENT ID	TECN	COMMENT
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NODE=M105R17
NODE=M105R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3±1.4	¹ ACHASOV	10D SND	1.075-2.0 $e^+e^- \rightarrow \pi^0\gamma$
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¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

NODE=M105R17;LINKAGE=A

$$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{18}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M105R01
NODE=M105R01

<4.0	90	ACHASOV	11 SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
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$$\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{19}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M105R02
NODE=M105R02

<2.6	90	ACHASOV	11 SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
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$$\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{20}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M105R03
NODE=M105R03

<3.5	90	ACHASOV	11 SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
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$$\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{21}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M105R04
NODE=M105R04

<0.8	90	¹ ACHASOV	11 SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
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¹ Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R01;LINKAGE=AC

$\rho(1450)$ BRANCHING RATIOS

NODE=M105225

 $\Gamma(\pi\pi)/\Gamma(4\pi)$ **Γ_1/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.37±0.10^{1,2} ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.² Using ABELE 97.NODE=M105R15
NODE=M105R15NODE=M105R;LINKAGE=BL
NODE=M105R;LINKAGE=LK **$\Gamma(K^+K^-)/\Gamma(\pi^+\pi^-)$** **$\Gamma_{14}/\Gamma_2$**

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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30.7±8.4±8.2 20k¹ LEES 17C BABR $J/\psi \rightarrow h^+h^-\pi^0$ ¹ From Dalitz plot analyses in isobar models.NODE=M105R08
NODE=M105R08

NODE=M105R08;LINKAGE=A

 $\Gamma(\omega\pi)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 821¹ MATVIENKO 15 BELL $\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$ seen 1.6k ACHASOV 12 SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

~ 0.21 CLEGG 94 RVUE

¹ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.NODE=M105R5
NODE=M105R5

NODE=M105R5;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\omega\pi)$ **Γ_1/Γ_4**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.32 CLEGG 94 RVUE

NODE=M105R6
NODE=M105R6 **$\Gamma(\omega\pi)/\Gamma(4\pi)$** **$\Gamma_4/\Gamma_3$**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.14 CLEGG 88 RVUE

NODE=M105R3
NODE=M105R3 **$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$** **$\Gamma_5/\Gamma_3$**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.27±0.08¹ ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.NODE=M105R10
NODE=M105R10

NODE=M105R10;LINKAGE=BL

 $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ **Γ_6/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.08±0.04¹ ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.NODE=M105R11
NODE=M105R11

NODE=M105R11;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ **Γ_7/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.37±0.13¹ ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.NODE=M105R12
NODE=M105R12

NODE=M105R12;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ **Γ_8/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.11±0.05¹ ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.NODE=M105R13
NODE=M105R13

NODE=M105R13;LINKAGE=BL

 $\Gamma(\rho(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$ **Γ_9/Γ_3**

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17±0.09¹ ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$ ¹ $\omega\pi$ not included.NODE=M105R14
NODE=M105R14

NODE=M105R14;LINKAGE=BL

$\Gamma(\eta\rho)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
seen	35	¹ ACHASOV	14	SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$	NODE=M105R2 NODE=M105R2
<0.04		DONNACHIE	87B	RVUE	

¹From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M105R2;LINKAGE=A

 $\Gamma(\eta\rho)/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ_4
0.081 ± 0.020	^{1,2} AULCHENKO	15	SND 1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$	NODE=M105R4 NODE=M105R4
~ 0.24	³ DONNACHIE	91	RVUE	
>2	FUKUI	91	SPEC 8.95 $\pi^-p \rightarrow \omega\pi^0n$	

¹From a fit to the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta\rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R4;LINKAGE=A

²Reports the inverse of the quoted value as 12.3 ± 3.1 .

NODE=M105R4;LINKAGE=B

³Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\eta\rho)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_{11}
1.3 ± 0.4	¹ AULCHENKO	15	SND 1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$	NODE=M105R07 NODE=M105R07

¹From a fit to the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta\rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R07;LINKAGE=A

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
not seen	AMELIN	00	VES 37 $\pi^-p \rightarrow \eta\pi^+\pi^-n$	NODE=M105R9 NODE=M105R9

 $\Gamma(K\bar{K})/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ_4
<0.08	¹ DONNACHIE	91	RVUE	NODE=M105R8 NODE=M105R8

¹Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R8;LINKAGE=A

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{15}/Γ
possibly seen	COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$	NODE=M105R16 NODE=M105R16

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{17}/Γ
seen	35	¹ ACHASOV	14	SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$	NODE=M105R06 NODE=M105R06

¹From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M105R06;LINKAGE=A

 $\rho(1450)$ REFERENCES

IGNATOV	24	PR D109 112002	F.V. Ignatov <i>et al.</i>	(CMD-3 Collab.)	REFID=62672
GRIBANOV	20	JHEP 2001 112	S.S. Gribov <i>et al.</i>	(CMD-3 Collab.)	REFID=60620
ACHASOV	18	PR D97 012008	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=58785
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58900
BARTOS	17	PR D96 113004	E. Bartos <i>et al.</i>		REFID=58325
BARTOS	17A	IJMP A32 1750154	E. Bartos <i>et al.</i>		REFID=58367
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM	16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57138
ACHASOV	16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57618
AULCHENKO	15	PR D91 052013	V.M. Aulchenko <i>et al.</i>	(SND Collab.)	REFID=56793
MATVIENKO	15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)	REFID=56601
ACHASOV	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55912
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
ACHASOV	12	JETPL 94 734	M.N. Achasov <i>et al.</i>		REFID=54275

Translated from ZETFP 94 796.

NODE=M105

LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ACHASOV	11	JETP 113 75	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=16721
		Translated from ZETF 140 87.			
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59494
DUBNICKA	10	APS 60 1	S. Dubnicka, A.Z. Dubnickova		REFID=58797
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
SCHAEEL	05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)	REFID=50845
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
ALEXANDER	01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48391
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46916
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45763
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
CLEGG	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)	REFID=40922
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
		Translated from ZETFP 37 613.			
ASTON	80C	PL 92B 211	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=20652
BARBER	80C	ZPHY C4 169	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)	REFID=20653
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

NODE=M175

η(1475)

$$I^G(J^{PC}) = 0^+(0^-+)$$

See the η(1405) and the related review on "Spectroscopy of Light Meson Resonances."

NODE=M175

η(1475) MASS

NODE=M175M5

NODE=M175M5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1476 ± 4 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1507.6 ± 1.6 ^{+15.5} _{-32.2}	126K	¹ ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1469 ± 14 ± 13	74	ACHARD	07 L3	$183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
1460 ± 12	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1485 ± 8 ± 5	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1500 ± 10		CICALO	99 OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1464 ± 10		BERTIN	97 OBLX	$0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1460 ± 10		BERTIN	95 OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
1490 ⁺¹⁴ ₋₈ ⁺³ ₋₁₆	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1475 ± 4		RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1477 ± 7 ± 13		² ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
1565 ± 8 ⁺⁰ ₋₆₃		³ ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
1421 ± 14		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

OCCUR=2

¹ ABLIKIM 23M reports for this state a significance from the fit much higher than 35 σ.

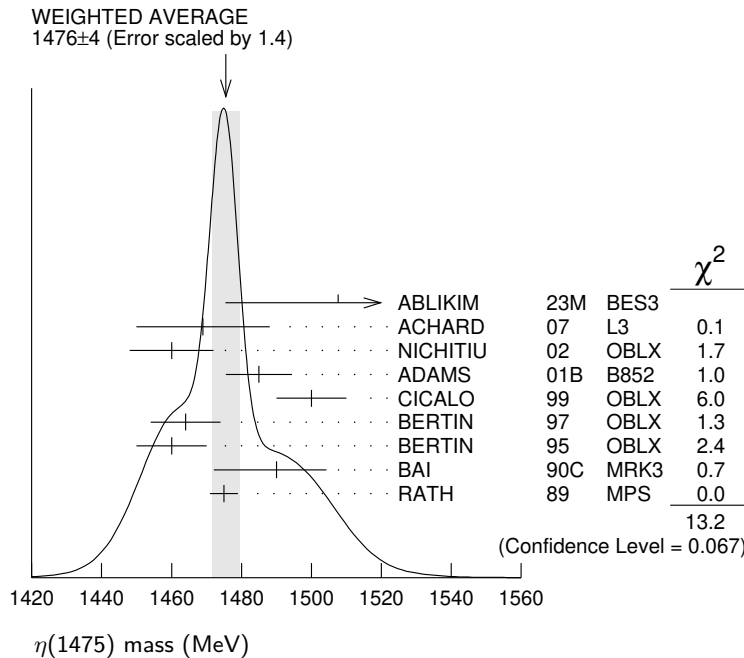
² From a fit to γφ invariant mass. Angular analysis consistent with J^{PC} = 0⁻⁺. Other J^{PC} not excluded.

³ Could also be the η(1405).

NODE=M175M5;LINKAGE=C

NODE=M175M5;LINKAGE=B

NODE=M175M5;LINKAGE=A



η(1475) WIDTH

NODE=M175W5

NODE=M175W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
96 ± 9 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
115.8 ± 2.4 ^{+14.8} _{-10.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
67 ± 18 ± 7	74	ACHARD	07 L3	$183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
120 ± 15	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
98 ± 18 ± 3	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
100 ± 20		CICALO	99 OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$

105 ±15	BERTIN	97	OBLX	0.0 $\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp\pi^+\pi^-$	OCCUR=2
105 ±15	BERTIN	95	OBLX	0 $\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$	OCCUR=2
54 $\begin{smallmatrix} +37 \\ -21 \end{smallmatrix}$ $\begin{smallmatrix} +13 \\ -24 \end{smallmatrix}$	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm\pi^\mp$	
51 ±13	RATH	89	MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

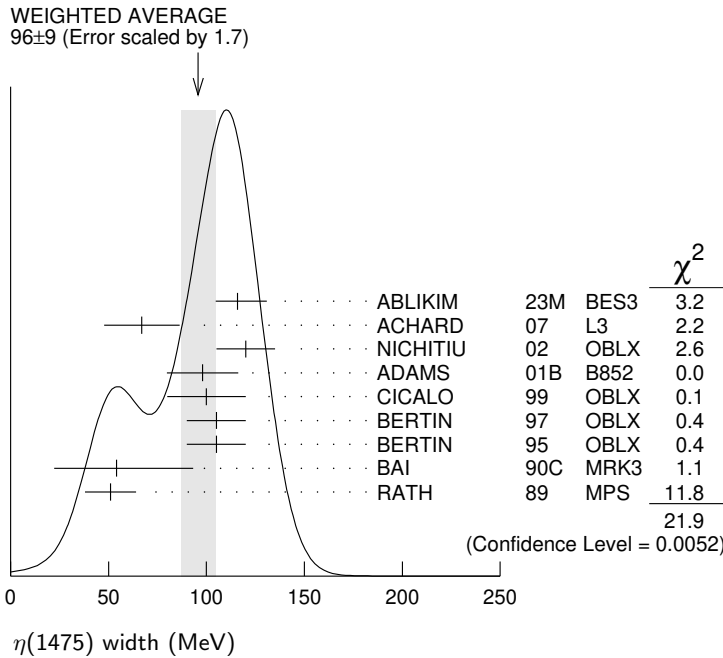
118 ±22 ±17	¹ ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$	
45 $\begin{smallmatrix} +14 \\ -13 \end{smallmatrix}$ $\begin{smallmatrix} +21 \\ -28 \end{smallmatrix}$	² ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$	
63 ±18	AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$	OCCUR=2

¹ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

² Could also be the $\eta(1405)$.

NODE=M175W5;LINKAGE=B

NODE=M175W5;LINKAGE=A



η(1475) DECAY MODES

NODE=M175215;NODE=M175

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}\pi$	seen
Γ_2 $K\bar{K}^*(892) + c.c.$	seen
Γ_3 $a_0(980)\pi$	seen
Γ_4 $\gamma\gamma$	seen
Γ_5 $K_S^0 K_S^0 \eta$	possibly seen
Γ_6 $\gamma\phi(1020)$	possibly seen

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=9

η(1475) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M175220

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$			$\Gamma_1\Gamma_4/\Gamma$		
VALUE (keV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.23±0.05±0.05		74	¹ ACHARD	07 L3	183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm\pi^\mp$

NODE=M175G2
 NODE=M175G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.089	90	^{2,3} AHOHE	05	CLE2	10.6 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm\pi^\mp$
---------	----	----------------------	----	------	---

¹ Supersedes ACCIARRI 01G. Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895$.

² Using $\eta(1475)$ mass of 1481 MeV and width of 48 MeV. The upper limit increases to 0.140 keV if the world average value, 87 MeV, of the width is used.

³ Assuming three-body phase-space decay to $K_S^0 K^\pm\pi^\mp$.

NODE=M175G2;LINKAGE=CH
 NODE=M175G2;LINKAGE=AH

NODE=M175G2;LINKAGE=B3

$\eta(1475)$ BRANCHING RATIOS

NODE=M175225

$$\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K}\pi) \quad \Gamma_2/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.50±0.10 ¹ BAILLON 67 HBC 0.0 $\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$ ¹ Data could also refer to $\eta(1405)$.NODE=M175R1
NODE=M175R1

NODE=M175R;LINKAGE=BL

$$\Gamma(K\bar{K}^*(892)+c.c.)/[\Gamma(K\bar{K}^*(892)+c.c.)+\Gamma(a_0(980)\pi)] \quad \Gamma_2/(\Gamma_2+\Gamma_3)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.25 90 EDWARDS 82E CBAL $J/\psi \rightarrow K^+K^-\pi^0\gamma$ NODE=M175R6
NODE=M175R6

$$\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi) \quad \Gamma_4/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.27 × 10⁻³ 90 ¹ ABLIKIM 180 BES3 $\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$ ¹ Using results from BAI 00D.NODE=M175R01
NODE=M175R01

NODE=M175R01;LINKAGE=A

$$\Gamma(\gamma\phi(1020))/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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possibly seen ¹ ABLIKIM 18I BES3 $J/\psi \rightarrow \gamma\gamma\phi(1020)$ ¹ Seen as a peak in $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded. Also see $\eta(1405)$.NODE=M175R00
NODE=M175R00

NODE=M175R00;LINKAGE=A

 $\eta(1475)$ REFERENCES

NODE=M175

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58893
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58925
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56785
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)	REFID=50764
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)	REFID=47394
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=44614
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)	REFID=20407

$f_0(1500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

 $f_0(1500)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1430–1530) – i (40–90) OUR ESTIMATE			
$(1450 \pm 10) - i (53 \pm 8)$	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1483 \pm 15) - i (58 \pm 6)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1496 \pm 1.2_{-26.4}^{+4.4}) - i$ $(40.4 \pm 0.3_{-2.5}^{+10.0})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 n, \pi^0 \eta\eta, \pi^0 K^+ K^-$
$(1465 \pm 18) - i (50 \pm 9)$	³ ROPERTZ	18	RVUE $\bar{B}_s^0 \rightarrow J/\psi(\pi^+ \pi^- / K^+ K^-)$
$(1486 \pm 10) - i (57 \pm 5)$	ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1489_{-4}^{+8}) - i (51 \pm 5)$	⁴ ANISOVICH	03	RVUE
$(1515 \pm 12) - i (55 \pm 12)$	BARBERIS	00A	$450 \bar{p}p \rightarrow p_f(\eta\eta', \eta'\eta')p_s$
$(1511 \pm 9) - i (51 \pm 9)$	⁵ BARBERIS	00C	$450 \bar{p}p \rightarrow p_f 4\pi p_s$
$(1510 \pm 8) - i (55 \pm 8)$	BARBERIS	00E	$450 \bar{p}p \rightarrow p_f \eta\eta p_s$
$(1502 \pm 12 \pm 10) - i$ $(49 \pm 9 \pm 8)$	⁶ BARBERIS	99D	OMEG $450 \bar{p}p \rightarrow K^+ K^-, \pi^+ \pi^-$
$(1447 \pm 27) - i (54 \pm 23)$	⁷ KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$(1499 \pm 8) - i (65 \pm 10)$	ANISOVICH	98B	RVUE Compilation.
$(1510 \pm 20) - i (60 \pm 18)$	BARBERIS	97B	OMEG $450 \bar{p}p \rightarrow p p 2(\pi^+ \pi^-)$
$(1449 \pm 20) - i (57 \pm 15)$	BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
$(1515 \pm 20) - i (53 \pm 8)$	ABELE	96B	CBAR $0.0 \bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
$(1500 \pm 8) - i (66 \pm 8)$	ABELE	96C	RVUE Compilation.
$(1500 \pm 10) - i (77 \pm 15)$	⁸ AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$
$(1520 \pm 25) - i (74_{-13}^{+10})$	⁹ ANISOVICH	94	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$
$(1505 \pm 20) - i (75 \pm 10)$	¹⁰ BUGG	94	RVUE $\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$

¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).

² T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).

³ T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.

⁴ Pole position from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n, \pi^- p \rightarrow K\bar{K}n, \pi^+ \pi^- \rightarrow \pi^+ \pi^-, \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta, \pi^+ \pi^- \pi^0, K^+ K^- \pi^0, K_S^0 K_S^0 \pi^0, K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+, K_S^0 K^- \pi^0, K_S^0 K_S^0 \pi^-$ at rest.

⁵ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.

⁶ Supersedes BARBERIS 99 and BARBERIS 99B.

⁷ T-matrix pole on sheet $--+$.

⁸ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

⁹ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$.

¹⁰ Reanalysis of ANISOVICH 94 data.

NODE=M152

NODE=M152

NODE=M152PP

NODE=M152PP

NODE=M152PP

→ UNCHECKED ←

NODE=M152PP;LINKAGE=E

NODE=M152PP;LINKAGE=A

NODE=M152PP;LINKAGE=F

NODE=M152PP;LINKAGE=G

NODE=M152PP;LINKAGE=C

NODE=M152PP;LINKAGE=H

NODE=M152PP;LINKAGE=I

NODE=M152PP;LINKAGE=D

NODE=M152PP;LINKAGE=J

NODE=M152PP;LINKAGE=K

 $f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1522 ± 25		¹ BERTIN	98	OBLX $0.05-0.405 \bar{p}p \rightarrow \pi^+ \pi^+ \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1492.5 \pm 3.6_{-20.5}^{+2.4}$		² ABLIKIM	22G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
$1447 \pm 16 \pm 13$	163	^{3,4} DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M152M

NODE=M152M

1442 ± 9 ± 4	261	3,4	DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$	OCCUR=2
1460.9 ± 2.9		5	AAIJ	14BR	LHCB $\bar{B}_S^0 \rightarrow J/\psi\pi^+\pi^-$	
1468 $\begin{smallmatrix} +14 & +23 \\ -15 & -74 \end{smallmatrix}$	5.5k	6	ABLIKIM	13N	BES3 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$	
1470 ± 60	568	7	KLEMP	08	E791 $D_S^+ \rightarrow \pi^-\pi^+\pi^+$	
1470 $\begin{smallmatrix} +6 & +72 \\ -7 & -255 \end{smallmatrix}$		8	UEHARA	08A	BELL $10.6 \begin{smallmatrix} e^+e^- \rightarrow \\ e^+e^-\pi^0\pi^0 \end{smallmatrix}$	
1466 ± 6 ± 20		9	ABLIKIM	06V	BES2 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$	
1495 ± 4			AMSLER	06	CBAR $0.9 \bar{p}p \rightarrow K^+K^-\pi^0$	
1539 ± 20	9.9k		AUBERT	06O	BABR $B^+ \rightarrow K^+K^+K^-$	
1473 ± 5	80k	9,10	UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta\eta\pi^0$	
1478 ± 6			VLADIMIRSK...	06	SPEC $40 \pi^-p \rightarrow K_S^0 K_S^0 n$	
1493 ± 7		9	BINON	05	GAMS $33 \pi^-p \rightarrow \eta\eta n$	
1524 ± 14	1400	11	GARMASH	05	BELL $B^+ \rightarrow K^+K^+K^-$	
1490 ± 30		9	ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^-4\pi^0 p$	
1497 ± 10		9	BARBERIS	99	OMEG $450 pp \rightarrow p_S p_f K^+K^-$	
1502 ± 10		9	BARBERIS	99B	OMEG $450 pp \rightarrow p_S p_f \pi^+\pi^-$	
1530 ± 45		9	BELLAZZINI	99	GAM4 $450 pp \rightarrow p p \pi^0 \pi^0$	
1505 ± 18		9	FRENCH	99	$300 pp \rightarrow p_f(K^+K^-)p_S$	
1580 ± 80		9	ALDE	98	GAM4 $100 \pi^-p \rightarrow \pi^0\pi^0 n$	
~ 1520			REYES	98	SPEC $800 pp \rightarrow p_S p_f K_S^0 K_S^0$	
~ 1475			FRABETTI	97D	E687 $D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$	
~ 1505			ABELE	96	CBAR $0.0 \bar{p}p \rightarrow 5\pi^0$	
1460 ± 20	120	9	AMELIN	96B	VES $37 \pi^-A \rightarrow \eta\eta\pi^-A$	
1500 ± 8			BUGG	96	RVUE	
1500 ± 15		12	AMSLER	95B	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$	
1505 ± 15		13	AMSLER	95C	CBAR $0.0 \bar{p}p \rightarrow \eta\eta\pi^0$	OCCUR=2
1445 ± 5		14	ANTINORI	95	OMEG $300,450 pp \rightarrow pp2(\pi^+\pi^-)$	
1497 ± 30		9	ANTINORI	95	OMEG $300,450 pp \rightarrow pp\pi^+\pi^-$	OCCUR=2
~ 1505			BUGG	95	MRK3 $J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	
1446 ± 5		9	ABATZIS	94	OMEG $450 pp \rightarrow pp2(\pi^+\pi^-)$	
1545 ± 25		9	AMSLER	94E	CBAR $0.0 \bar{p}p \rightarrow \pi^0\eta\eta'$	
1560 ± 25		9	AMSLER	92	CBAR $0.0 \bar{p}p \rightarrow \pi^0\eta\eta$	
1550 ± 45 ± 30		9	BELADIDZE	92C	VES $36 \pi^-Be \rightarrow \pi^-\eta'\eta Be$	
1449 ± 4		9	ARMSTRONG	89E	OMEG $300 pp \rightarrow pp2(\pi^+\pi^-)$	
1610 ± 20		9	ALDE	88	GAM4 $300 \pi^-N \rightarrow \pi^-N2\eta$	
~ 1525			ASTON	88D	LASS $11 K^-p \rightarrow K_S^0 K_S^0 \Lambda$	
1570 ± 20	600	9	ALDE	87	GAM4 $100 \pi^-p \rightarrow 4\pi^0 n$	
1575 ± 45		15	ALDE	86D	GAM4 $100 \pi^-p \rightarrow 2\eta n$	
1568 ± 33		9	BINON	84C	GAM2 $38 \pi^-p \rightarrow \eta\eta' n$	
1592 ± 25		9	BINON	83	GAM2 $38 \pi^-p \rightarrow 2\eta n$	
1525 ± 5		9	GRAY	83	DBC $0.0 \bar{p}N \rightarrow 3\pi$	
¹ Breit-Wigner mass. NODE=M152M;LINKAGE=PP						
² The $\pi^+\pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0 \begin{smallmatrix} +36.3 \\ -6.1 \end{smallmatrix}$ MeV and width $157 \pm 19 \begin{smallmatrix} +11 \\ -77 \end{smallmatrix}$ MeV. NODE=M152M;LINKAGE=M						
³ Using CLEO-c data but not authored by the CLEO Collaboration. NODE=M152M;LINKAGE=F						
⁴ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 109$ MeV. NODE=M152M;LINKAGE=G						
⁵ Solution 1, statistical error only. NODE=M152M;LINKAGE=I						
⁶ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances. NODE=M152M;LINKAGE=C						
⁷ Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$. NODE=M152M;LINKAGE=KL						
⁸ Breit-Wigner mass. May also be the $f_0(1370)$. NODE=M152M;LINKAGE=UE						
⁹ Breit-Wigner mass. NODE=M152M;LINKAGE=E						
¹⁰ Statistical error only. NODE=M152M;LINKAGE=ST						
¹¹ Breit-Wigner, solution 1, PWA ambiguous. NODE=M152M;LINKAGE=GA						
¹² T-matrix pole, supersedes ANISOVICH 94. NODE=M152M;LINKAGE=D						
¹³ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92. NODE=M152M;LINKAGE=D1						
¹⁴ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass. NODE=M152M;LINKAGE=B						
¹⁵ From central value and spread of two solutions. Breit-Wigner mass. NODE=M152M;LINKAGE=AZ						

$f_0(1500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M152W
108 ± 33		¹ BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$	NODE=M152W
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
107 ± 9 ⁺ ₇		² ABLIKIM	22G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
124 ± 7		³ AAIJ	14BR	LHCB $\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$	
136 ⁺ ₂₆ 41 ⁺ ₁₀₀ 28 ₁₀₀	5.5k	⁴ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$	
90 ⁺ ₁ 2 ⁺ ₂₂ 50 ₂₂		⁵ UEHARA	08A	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$	
108 ⁺ ₁₁ 14 ± 25		⁶ ABLIKIM	06V	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$	
121 ± 8		AMSLER	06	CBAR 0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$	
257 ± 33	9.9k	AUBERT	06O	BABR $B^+ \rightarrow K^+ K^+ K^-$	
108 ± 9	80k	^{6,7} UMAN	06	E835 5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$	
119 ± 10		VLADIMIRSK...	06	SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	
90 ± 15		⁶ BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$	
136 ± 23	1400	⁸ GARMASH	05	BELL $B^+ \rightarrow K^+ K^+ K^-$	
140 ± 40		⁶ ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$	
104 ± 25		⁶ BARBERIS	99	OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$	
131 ± 15		⁶ BARBERIS	99B	OMEG 450 $pp \rightarrow p_s p_f \pi^+ \pi^-$	
160 ± 50		⁶ BELLAZZINI	99	GAM4 450 $pp \rightarrow pp \pi^0 \pi^0$	
100 ± 33		⁶ FRENCH	99	300 $pp \rightarrow p_f (K^+ K^-) p_s$	
280 ± 100		⁶ ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$	
~ 100		FRABETTI	97D	E687 $D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$	
~ 169		ABELE	96	CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$	
100 ± 30	120	⁶ AMELIN	96B	VES 37 $\pi^- A \rightarrow \eta \eta \pi^- A$	
132 ± 15		BUGG	96	RVUE	
120 ± 25		⁹ AMSLER	95B	CBAR 0.0 $\bar{p}p \rightarrow 3\pi^0$	
120 ± 30		¹⁰ AMSLER	95C	CBAR 0.0 $\bar{p}p \rightarrow \eta \eta \pi^0$	OCCUR=2
65 ± 10		¹¹ ANTINORI	95	OMEG 300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$	
199 ± 30		⁶ ANTINORI	95	OMEG 300,450 $pp \rightarrow pp\pi^+ \pi^-$	OCCUR=2
56 ± 12		⁶ ABATZIS	94	OMEG 450 $pp \rightarrow pp2(\pi^+ \pi^-)$	
100 ± 40		⁶ AMSLER	94E	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \eta \eta'$	
245 ± 50		⁶ AMSLER	92	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \eta \eta$	
153 ± 67 ± 50		⁶ BELADIDZE	92C	VES 36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$	
78 ± 18		⁶ ARMSTRONG	89E	OMEG 300 $pp \rightarrow pp2(\pi^+ \pi^-)$	
170 ± 40		⁶ ALDE	88	GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$	
150 ± 20	600	⁶ ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$	
265 ± 65		¹² ALDE	86D	GAM4 100 $\pi^- p \rightarrow 2\eta n$	
260 ± 60		⁶ BINON	84C	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$	
210 ± 40		⁶ BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$	
101 ± 13		⁶ GRAY	83	DBC 0.0 $\bar{p}N \rightarrow 3\pi$	

¹ Breit-Wigner width.

² The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.

³ Solution I, statistical error only.

⁴ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁵ Breit-Wigner width. May also be the $f_0(1370)$.

⁶ Breit-Wigner width.

⁷ Statistical error only.

⁸ Breit-Wigner, solution 1, PWA ambiguous.

⁹ T-matrix pole, supersedes ANISOVICH 94.

¹⁰ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

¹¹ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

¹² From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152W;LINKAGE=PP
NODE=M152W;LINKAGE=J

NODE=M152W;LINKAGE=G
NODE=M152W;LINKAGE=C

NODE=M152W;LINKAGE=UE
NODE=M152W;LINKAGE=E
NODE=M152W;LINKAGE=ST
NODE=M152W;LINKAGE=GA
NODE=M152W;LINKAGE=D
NODE=M152W;LINKAGE=D1
NODE=M152W;LINKAGE=B
NODE=M152W;LINKAGE=AZ

$f_0(1500)$ DECAY MODES

NODE=M152215;NODE=M152

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 $\pi\pi$	(34.5±2.2) %	1.2
Γ_2 $\pi^+\pi^-$	seen	
Γ_3 $2\pi^0$	seen	
Γ_4 4π	(48.9±3.3) %	1.2
Γ_5 $4\pi^0$	seen	
Γ_6 $2\pi^+2\pi^-$	seen	
Γ_7 $2(\pi\pi)_{S\text{-wave}}$	seen	
Γ_8 $\rho\rho$	seen	
Γ_9 $\pi(1300)\pi$	seen	
Γ_{10} $a_1(1260)\pi$	seen	
Γ_{11} $\eta\eta$	(6.0±0.9) %	1.1
Γ_{12} $\eta\eta'(958)$	(2.2±0.8) %	1.4
Γ_{13} $K\bar{K}$	(8.5±1.0) %	1.1
Γ_{14} $\gamma\gamma$	not seen	

DESIG=8
DESIG=9
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=7
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=12;OUR EST;→ UNCHECKED ←
DESIG=13;OUR EST;→ UNCHECKED ←
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=2
DESIG=4
DESIG=10;OUR EST;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 5.6$ for 6 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_4	-88			
x_{11}	27	-56		
x_{12}	3	-32	26	
x_{13}	43	-64	20	2
	x_1	x_4	x_{11}	x_{12}

 $f_0(1500)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M152217

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_{14}/\Gamma$
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NODE=M152G1
NODE=M152G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$33^{+12}_{-6} + 1809_{21}$		¹ UEHARA	08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
not seen		ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{ee} = 91, 183\text{--}209 \text{ GeV}$
<460	95	BARATE	00E	ALEP	$\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.

NODE=M152G1;LINKAGE=UE

 $f_0(1500)$ BRANCHING RATIOS

NODE=M152220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	Γ_1/Γ
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NODE=M152R8
NODE=M152R8

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.454±0.104	BUGG	96	RVUE
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$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
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NODE=M152R10
NODE=M152R10

seen BERTIN 98 OBLX 0.05–0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen FRABETTI 97D E687 $D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

$\Gamma(4\pi)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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1.42±0.18 OUR FIT Error includes scale factor of 1.2.**1.42±0.18 OUR AVERAGE** Error includes scale factor of 1.2.1.37±0.16 BARBERIS 00D 450 $p\bar{p} \rightarrow p_f 4\pi p_s$ 2.1 ±0.6 ¹ AMSLER 98 RVUE

••• We do not use the following data for averages, fits, limits, etc. •••

2.1 ±0.2 ² ANISOVICH 02D SPEC Combined fit3.4 ±0.8 ¹ ABELE 96 CBAR 0.0 $\bar{p}p \rightarrow 5\pi^0$ ¹ Excluding $\rho\rho$ contribution to 4π .² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.NODE=M152R6
NODE=M152R6NODE=M152R6;LINKAGE=C
NODE=M152R6;LINKAGE=CH $\Gamma(2(\pi\pi)S\text{-wave})/\Gamma(\pi\pi)$ Γ_7/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.42±0.26 ¹ ABELE 01 CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$ ¹ From the combined data of ABELE 96 and ABELE 96C.NODE=M152R14
NODE=M152R14

NODE=M152R;LINKAGE=KZ

 $\Gamma(2(\pi\pi)S\text{-wave})/\Gamma(4\pi)$ Γ_7/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.26±0.07 ABELE 01B CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$ NODE=M152R15
NODE=M152R15 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_8/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.13±0.08 ABELE 01B CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$ NODE=M152R16
NODE=M152R16 $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)S\text{-wave})$ Γ_8/Γ_7

VALUE	DOCUMENT ID	COMMENT
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2.87±0.34 OUR AVERAGE Error includes scale factor of 1.1.3.3 ±0.5 BARBERIS 00C 450 $p\bar{p} \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$ 2.6 ±0.4 BARBERIS 00C 450 $p\bar{p} \rightarrow p_f 2(\pi^+ \pi^-) p_s$ NODE=M152R11
NODE=M152R11

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.50±0.25 ABELE 01B CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$ NODE=M152R17
NODE=M152R17 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.12±0.05 ABELE 01B CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$ NODE=M152R18
NODE=M152R18 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

large ALDE 88 GAM4 300 $\pi^- N \rightarrow \eta\eta\pi^- N$ large BINON 83 GAM2 38 $\pi^- p \rightarrow 2\eta n$ NODE=M152R1
NODE=M152R1 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.173±0.024 OUR FIT Error includes scale factor of 1.1.**0.175±0.027 OUR AVERAGE**0.18 ±0.03 BARBERIS 00E 450 $p\bar{p} \rightarrow p_f \eta\eta p_s$ 0.157±0.060 ¹ AMSLER 95D CBAR 0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$

••• We do not use the following data for averages, fits, limits, etc. •••

0.080±0.033 AMSLER 02 CBAR 0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$ 0.11 ±0.03 ² ANISOVICH 02D SPEC Combined fit0.078±0.013 ³ ABELE 96C RVUE Compilation0.230±0.097 ⁴ AMSLER 95C CBAR 0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$ ¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.³ 2π width determined to be 60 ± 12 MeV.⁴ Using AMSLER 95B ($3\pi^0$).NODE=M152R13
NODE=M152R13NODE=M152R3;LINKAGE=AB
NODE=M152R;LINKAGE=CHNODE=M152R3;LINKAGE=CM
NODE=M152R3;LINKAGE=A

$\Gamma(4\pi^0)/\Gamma(\eta\eta)$ Γ_5/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.8 ± 0.3	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

NODE=M152R5
 NODE=M152R5

 $\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$ Γ_{12}/Γ_1

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
6.4 ± 2.2 OUR FIT	Error includes scale factor of 1.4.		
9.5 ± 2.6	BARBERIS	00A	450 $p\bar{p} \rightarrow p_f \eta \eta p_S$
16.6 ^{+4.2} _{-4.0}	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma \eta \eta'$
0.5 ± 0.3	² ANISOVICH	02D	SPEC Combined fit

NODE=M152R12
 NODE=M152R12

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.
² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M152R12;LINKAGE=A
 NODE=M152R12;LINKAGE=CH

 $\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$ Γ_{12}/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.37 ± 0.13 OUR FIT	Error includes scale factor of 1.5.		
0.29 ± 0.10	¹ AMSLER	95C	CBAR 0.0 $p\bar{p} \rightarrow \eta \eta \pi^0$
0.05 ± 0.03	² ANISOVICH	02D	SPEC Combined fit
0.84 ± 0.23	ABELE	96C	RVUE Compilation
2.7 ± 0.8	BINON	84C	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$

NODE=M152R2
 NODE=M152R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using AMSLER 94E ($\eta \eta' \pi^0$).
² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M152R2;LINKAGE=A
 NODE=M152R2;LINKAGE=CH

 $\Gamma(K\bar{K})/\Gamma_{total}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.044 ± 0.021	BUGG	96	RVUE

NODE=M152R9
 NODE=M152R9

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_{13}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.246 ± 0.025 OUR FIT			
0.236 ± 0.026 OUR AVERAGE			
0.25 ± 0.03	¹ BARGIOTTI	03	OBLX $p\bar{p}$
0.19 ± 0.07	² ABELE	98	CBAR 0.0 $p\bar{p} \rightarrow K_S^0 K^\pm \pi^\mp$
0.20 ± 0.08	³ ABELE	96B	CBAR 0.0 $p\bar{p} \rightarrow \pi^0 K_L^0 K_L^0$
0.16 ± 0.05	⁴ ANISOVICH	02D	SPEC Combined fit
0.33 ± 0.03 ± 0.07	BARBERIS	99D	OMEG 450 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

NODE=M152R7
 NODE=M152R7

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.
² Using $\pi^0 \pi^0$ from AMSLER 95B.
³ Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0 \eta$) and SU(3).
⁴ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M152R;LINKAGE=BG
 NODE=M152R7;LINKAGE=A
 NODE=M152R7;LINKAGE=D
 NODE=M152R7;LINKAGE=CH

 $\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_{13}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.43 ± 0.24 OUR FIT	Error includes scale factor of 1.1.			
1.85 ± 0.41		BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_S$
1.5 ± 0.6		¹ ANISOVICH	02D	SPEC Combined fit
< 0.4	90	² PROKOSHKIN	91	GAM4 300 $\pi^- p \rightarrow \pi^- p \eta \eta$
< 0.6		³ BINON	83	GAM2 38 $\pi^- p \rightarrow 2\eta n$

NODE=M152R4
 NODE=M152R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.
² Combining results of GAM4 with those of WA76 on $K \bar{K}$ central production.
³ Using ETKIN 82B and COHEN 80.

NODE=M152R4;LINKAGE=CH
 NODE=M152R4;LINKAGE=BZ
 NODE=M152R4;LINKAGE=A

f₀(1500) REFERENCES

NODE=M152

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also		PR D107 079901 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
ABLIKIM	22G	PRL 129 042001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61642
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ROPERTZ	18	EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)	REFID=59332
AAIJ	17V	JHEP 1708 037	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57828
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
AAIJ	14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56035
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
KLEMP	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)	REFID=52286
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51141
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.			
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=50641
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47428
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47957
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	00D	PL B474 423	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47960
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>		REFID=47400
FRENCH	99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)	REFID=47491
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45863
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.			
AMSLER	98	RMP 70 1293	C. Amsler		REFID=46601
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
REYES	98	PRL 81 4079	M.A. Reyes <i>et al.</i>		REFID=46378
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
FRABETTI	97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=45554
ABELE	96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45011
ABELE	96B	PL B385 425	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45038
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45076
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44725
		Translated from YAF 59 1021.			
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)	REFID=45094
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44440
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44437
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44090
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AMSLER	94E	PL B340 259	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44080
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)	REFID=43175
		Translated from YAF 55 2748.			
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
ALDE	88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40283
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=21418
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
		Translated from YAF 38 934.			
GRAY	83	PR D27 307	L. Gray <i>et al.</i>	(SYRA)	REFID=21370
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)	REFID=20381
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355

f₁(1510)

$$I^G(J^{PC}) = 0^+(1^{++})$$

OMITTED FROM SUMMARY TABLE

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M084

NODE=M084

NODE=M084M

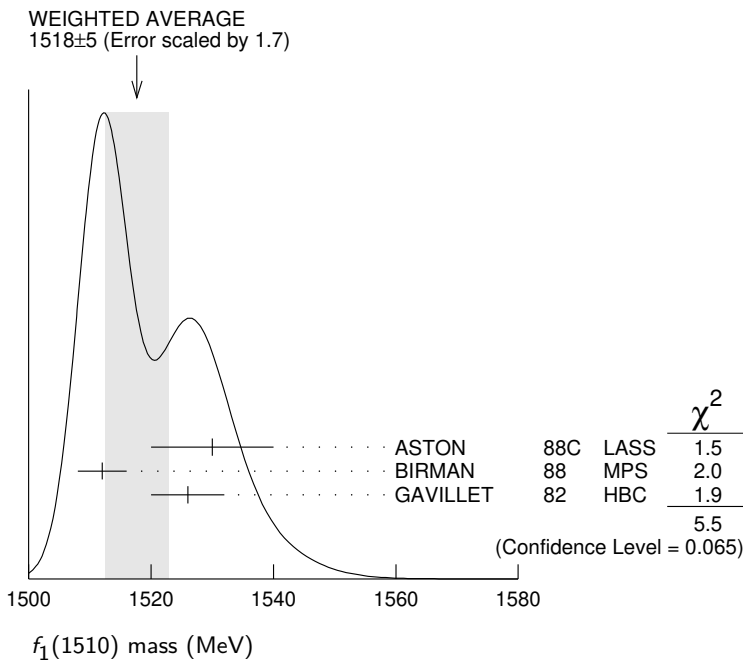
NODE=M084M

f₁(1510) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1518 ± 5 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.				
1530 ± 10		ASTON	88C LASS	11 K ⁻ p → K _S ⁰ K [±] π [∓] Λ
1512 ± 4	600	¹ BIRMAN	88 MPS	8 π ⁻ p → K ⁺ K ⁰ π ⁻ n
1526 ± 6	271	GAVILLET	82 HBC	4.2 K ⁻ p → ΛK K π
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 1525		² BAUER	93B	γγ* → π ⁺ π ⁻ π ⁰ π ⁰
¹ From partial wave analysis of K ⁺ K ⁰ π ⁻ state.				
² Not seen by AIHARA 88C in the K _S ⁰ K [±] π [∓] final state.				

NODE=M084M;LINKAGE=A

NODE=M084M;LINKAGE=C



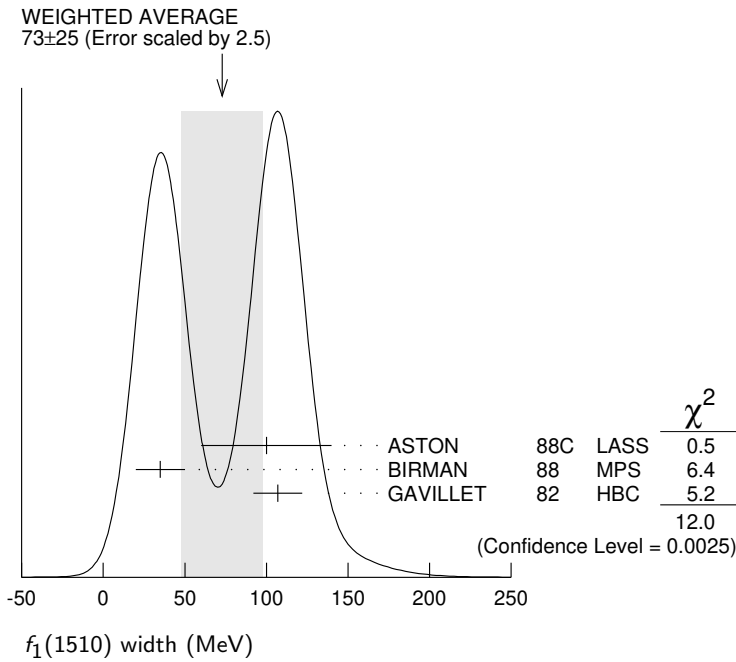
f₁(1510) WIDTH

NODE=M084W

NODE=M084W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
73 ± 25 OUR AVERAGE Error includes scale factor of 2.5. See the ideogram below.				
100 ± 40		ASTON	88C LASS	11 K ⁻ p → K _S ⁰ K [±] π [∓] Λ
35 ± 15	600	³ BIRMAN	88 MPS	8 π ⁻ p → K ⁺ K ⁰ π ⁻ n
107 ± 15	271	GAVILLET	82 HBC	4.2 K ⁻ p → ΛK K π
³ From partial wave analysis of K ⁺ K ⁰ π ⁻ state.				

NODE=M084W;LINKAGE=A



$f_1(1510)$ DECAY MODES

NODE=M084215;NODE=M084

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}^*(892) + c.c.$	seen
Γ_2 $\pi^+ \pi^- \eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

$f_1(1510)$ BRANCHING RATIOS

NODE=M084225

$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{total}$	Γ_2/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	230	ABLIKIM 11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M084R01
NODE=M084R01

$f_1(1510)$ REFERENCES

NODE=M084

ABLIKIM 11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BAUER 93B	PR D48 3976	D.A. Bauer <i>et al.</i>	(SLAC)
AIHARA 88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
ASTON 88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BIRMAN 88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
GAVILLET 82	ZPHY C16 119	P. Gavillet <i>et al.</i>	(CERN, CDEF, PADO+)

REFID=53684
REFID=43678
REFID=40564
REFID=40282
REFID=40568
REFID=20877

NODE=M013

$f'_2(1525)$

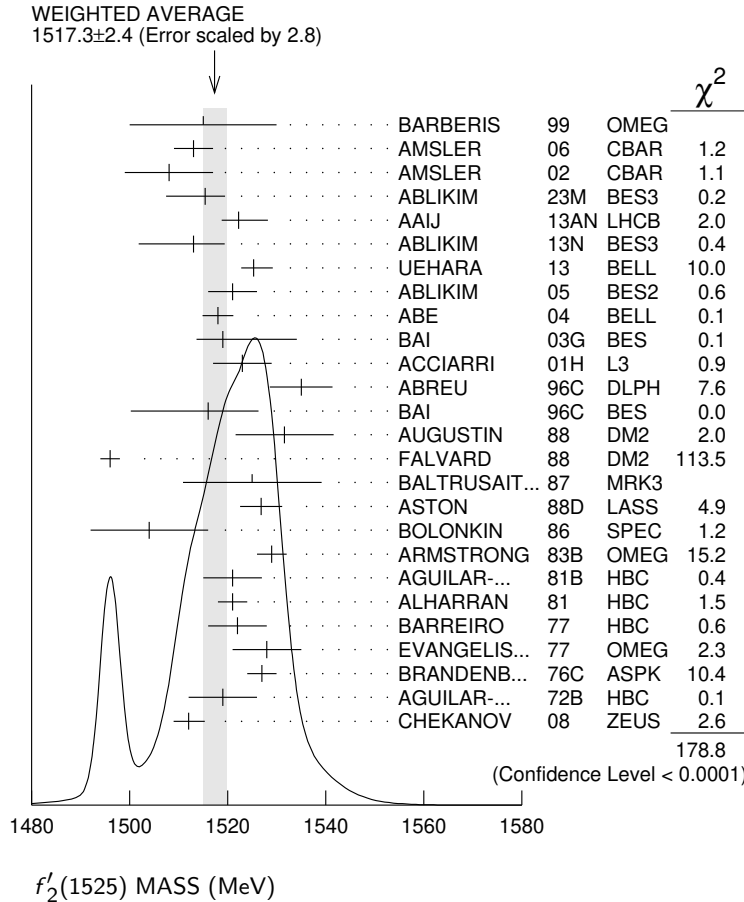
$$I^G(J^{PC}) = 0^+(2^{++})$$

$f'_2(1525)$ MASS

NODE=M013MX

NODE=M013MX

VALUE (MeV) DOCUMENT ID
1517.3±2.4 OUR AVERAGE Includes data from the 6 datablocks that follow this one.
 Error includes scale factor of 2.8. See the ideogram below.



PRODUCED BY PION BEAM

NODE=M013M1
 NODE=M013M1

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
 The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

1521±13		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1547 ⁺¹⁰ / ₋₂	1	LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1496 ⁺⁹ / ₋₈	2	CHABAUD 81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
1497 ⁺⁸ / ₋₉		CHABAUD 81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
1492±29		GORLICH 80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
1502±25	3	CORDEN 79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
1480	14	CRENNELL 66	HBC	6.0 $\pi^- p \rightarrow K_S^0 K_S^0 n$

OCCUR=2

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
² CHABAUD 81 is a reanalysis of PAWLICKI 77 data.
³ From an amplitude analysis where the $f'_2(1525)$ width and elasticity are in complete disagreement with the values obtained from $K\bar{K}$ channel, making the solution dubious.

NODE=M013M;LINKAGE=L
 NODE=M013M;LINKAGE=D
 NODE=M013M;LINKAGE=N

PRODUCED BY K^\pm BEAM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M013M2
NODE=M013M2

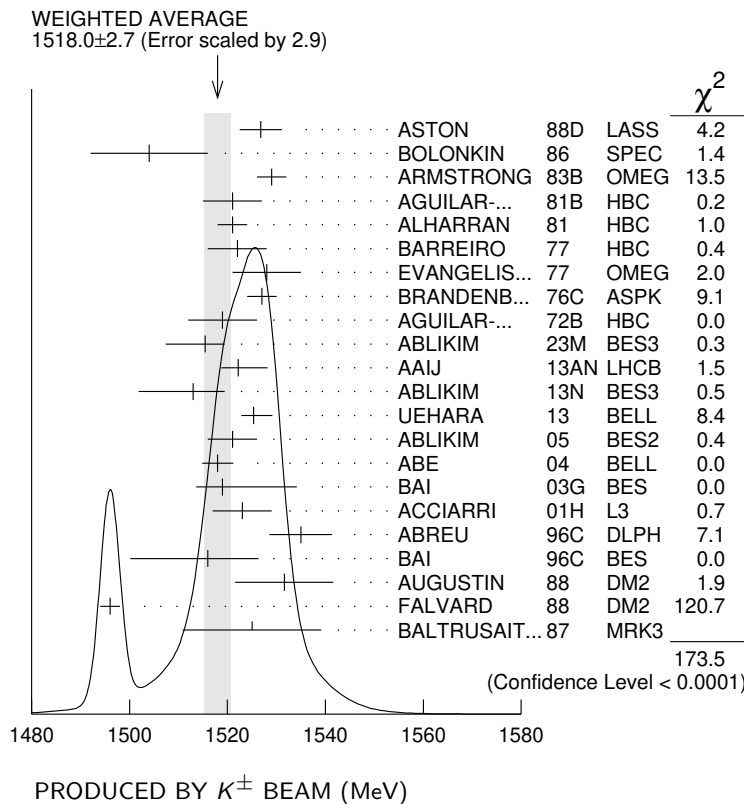
The data in this block is included in the average printed for a previous datablock.

1518.0 ± 2.7 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 2.9. See the ideogram below.

1526.8 ± 4.3		ASTON	88D	LASS	11	$K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1504 ± 12		BOLONKIN	86	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 Y$
1529 ± 3		ARMSTRONG	83B	OMEG	18.5	$K^- p \rightarrow K^- K^+ \Lambda$
1521 ± 6	650	AGUILAR-...	81B	HBC	4.2	$K^- p \rightarrow \Lambda K^+ K^-$
1521 ± 3	572	ALHARRAN	81	HBC	8.25	$K^- p \rightarrow \Lambda K \bar{K}$
1522 ± 6	123	BARREIRO	77	HBC	4.15	$K^- p \rightarrow \Lambda K_S^0 K_S^0$
1528 ± 7	166	EVANGELIS...	77	OMEG	10	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1527 ± 3	120	BRANDENB...	76c	ASPK	13	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1519 ± 7	100	AGUILAR-...	72B	HBC	3.9,4.6	$K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
1514 ± 8	61	BINON	07	GAMS	32.5	$K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
1513 ± 10		¹ BARKOV	99	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 y$

¹ Systematic errors not estimated.

NODE=M013M2;LINKAGE=SK



PRODUCED IN $e^+ e^-$ ANNIHILATION AND PARTICLE DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M013M3
NODE=M013M3

The data in this block is included in the average printed for a previous datablock.

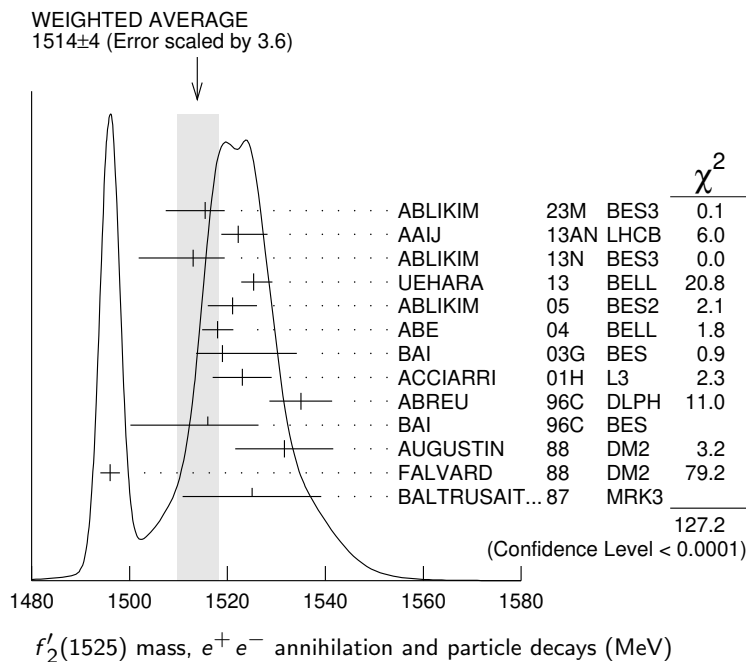
1514 ± 4 OUR AVERAGE Error includes scale factor of 3.6. See the ideogram below.

1515.4 ± 2.5 ⁺ _{7.6}	126K	ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1522.2 ± 2.8 ⁺ _{2.0}		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
1513 ± 5 ⁺ ₁₀	5.5k	¹ ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1525.3 ⁺ _{1.4-2.1}		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1521 ± 5		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
1518 ± 1 ± 3		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1519 ± 2 ⁺ ₅		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$

1523 ± 6	331	² ACCIARRI	01H L3	91, 183-209	$e^+e^- \rightarrow e^+e^-K_S^0K_S^0$
1535 ± 5 ± 4		ABREU	96C DLPH	$Z^0 \rightarrow K^+K^- + X$	
1516 ± 5 ⁺⁹ / ₋₁₅		BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$	
1531.6 ± 10.0		AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+K^-$	
1496 ± 2		³ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+K^-$	OCCUR=2
1525 ± 10 ± 10		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+K^-$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1518 ± 3		⁴ KLEMPPT	22 RVUE	$J/\psi(1S) \rightarrow \gamma \pi^0 \pi^0, \gamma K_S^0 K_S^0$	
1503 ± 11		⁵ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$	
1532 ± 3 ± 6	644	^{6,7} DOBBS	15	$J/\psi \rightarrow \gamma K^+K^-$	
1557 ± 9 ± 3	113	^{6,7} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+K^-$	OCCUR=2
1526 ± 7	29	⁸ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+K^- \gamma$	
1523 ± 5	870	⁹ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
1515 ± 5		¹⁰ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+K^-$	

- ¹ From partial wave analysis including all possible combinations of $0^{++}, 2^{++},$ and 4^{++} resonances.
- ² Supersedes ACCIARRI 95J.
- ³ From an analysis including interference with $f_0(1710)$.
- ⁴ Fit of the tensor partial waves from BES3 in the multipole basis.
- ⁵ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
- ⁶ Using CLEO-c data but not authored by the CLEO Collaboration.
- ⁷ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 73$ MeV.
- ⁸ From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.
- ⁹ From analysis of L3 data at 91 and 183-209 GeV.
- ¹⁰ From an analysis ignoring interference with $f_0(1710)$.

NODE=M013M3;LINKAGE=A
 NODE=M013M;LINKAGE=HA
 NODE=M013M;LINKAGE=F2
 NODE=M013M3;LINKAGE=F
 NODE=M013M3;LINKAGE=E
 NODE=M013M3;LINKAGE=B
 NODE=M013M3;LINKAGE=C
 NODE=M013M3;LINKAGE=D
 NODE=M013M3;LINKAGE=SC
 NODE=M013M;LINKAGE=F1



PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV) _____ DOCUMENT ID _____ TECN _____ COMMENT _____
 The data in this block is included in the average printed for a previous datablock.

NODE=M013M9
 NODE=M013M9

1512 ± 4 OUR AVERAGE

1513 ± 4		AMSLER	06 CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1508 ± 9		¹ AMSLER	02 CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1495.0 ± 1.1 ± 8.1		² ALBRECHT	20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
1530 ± 12		³ ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$

- ¹ T-matrix pole.
- ² T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).
- ³ 4-poles, 5-channel K matrix fit.

NODE=M013M;LINKAGE=TT
 NODE=M013M9;LINKAGE=A

NODE=M013M9;LINKAGE=AN

NODE=M013M4
 NODE=M013M4

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

1515±15 BARBERIS 99 OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M013M10
 NODE=M013M10

1512±3^{+1.4}_{-0.5} ¹ CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

••• We do not use the following data for averages, fits, limits, etc. •••

1537⁺⁹₋₈ 84 ² CHEKANOV 04 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

- ¹ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.
- ² Systematic errors not estimated.

NODE=M013M10;LINKAGE=HE

NODE=M013M10;LINKAGE=CH

$f_2'(1525)$ WIDTH

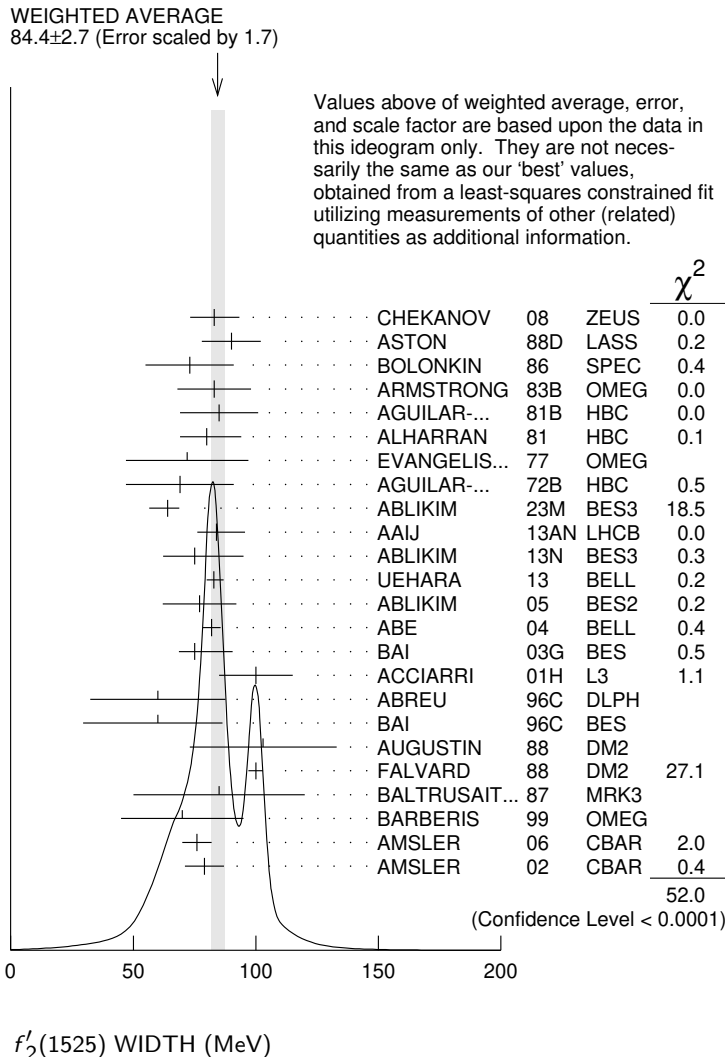
NODE=M013WX

NODE=M013WX

VALUE (MeV)	DOCUMENT ID
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72 ⁺⁷₋₆ OUR FIT

84.4±2.7 OUR AVERAGE Includes data from the 6 datablocks that follow this one. Error includes scale factor of 1.7. See the ideogram below.



PRODUCED BY PION BEAM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

102±42	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
108 ⁺⁵ ₋₂	¹ LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
69 ⁺²² ₋₁₆	² CHABAUD 81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
137 ⁺²³ ₋₂₁	CHABAUD 81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
150 ⁺⁸³ ₋₅₀	GORLICH 80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
165±42	³ CORDEN 79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
92 ⁺³⁹ ₋₂₂	⁴ POLYCHRO... 79	STRC	7 $\pi^- p \rightarrow n K_S^0 K_S^0$

NODE=M013W1
NODE=M013W1

OCCUR=2

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.² CHABAUD 81 is a reanalysis of PAWLICKI 77 data.³ From an amplitude analysis where the $f_2'(1525)$ width and elasticity are in complete disagreement with the values obtained from $K\bar{K}$ channel, making the solution dubious.⁴ From a fit to the D with $f_2(1270)$ - $f_2'(1525)$ interference. Mass fixed at 1516 MeV.NODE=M013W;LINKAGE=L
NODE=M013W;LINKAGE=D

NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M

PRODUCED BY K^\pm BEAM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M013W2
NODE=M013W2**82± 6 OUR AVERAGE**

90±12	ASTON 88D	LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
73±18	BOLONKIN 86	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$
83±15	ARMSTRONG 83B	OMEG	18.5 $K^- p \rightarrow K^- K^+ \Lambda$
85±16	650 AGUILAR-...	81B HBC	4.2 $K^- p \rightarrow \Lambda K^+ K^-$
80 ⁺¹⁴ ₋₁₁	572 ALHARRAN 81	HBC	8.25 $K^- p \rightarrow \Lambda K\bar{K}$
72±25	166 EVANGELIS...	77 OMEG	10 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
69±22	100 AGUILAR-...	72B HBC	3.9,4.6 $K^- p \rightarrow K\bar{K} (\Lambda, \Sigma)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

92 ⁺²⁵ ₋₁₆	61 BINON 07	GAMS	32.5 $K^- p \rightarrow \eta\eta (\Lambda/\Sigma^0)$
75±20	¹ BARKOV 99	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$
62 ⁺¹⁹ ₋₁₄	123 BARREIRO 77	HBC	4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
61± 8	120 BRANDENB... 76C	ASPK	13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

¹ Systematic errors not estimated.

NODE=M013W2;LINKAGE=SK

PRODUCED IN e^+e^- ANNIHILATION AND PARTICLE DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M013W3
NODE=M013W3**86 ± 4 OUR AVERAGE** Error includes scale factor of 2.4. See the ideogram below.

64.0± 4.3 ^{+2.0} _{-6.1}	126K	ABLIKIM 23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
84 ± 6 ⁺¹⁰ ₋₅		AAIJ 13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
75 ⁺¹² ₋₁₀ ⁺¹⁶ ₋₈	5.5k	¹ ABLIKIM 13N	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
82.9 ^{+2.1} _{-2.2} ^{+3.3} _{-2.0}		UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
77 ± 15		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
82 ± 2 ± 3		ABE 04	BELL	10.6 $e^+e^- \rightarrow e^+e^- K^+ K^-$
75 ± 4 ⁺¹⁵ ₋₅		BAI 03G	BES	$J/\psi \rightarrow \gamma K\bar{K}$
100 ± 15	331	² ACCIARRI 01H	L3	91, 183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
60 ± 20 ± 19		ABREU 96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
60 ± 23 ⁺¹³ ₋₂₀		BAI 96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
103 ± 30		AUGUSTIN 88	DM2	$J/\psi \rightarrow \gamma K^+ K^-$
100 ± 3		³ FALVARD 88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
85 ± 35		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M013W10
 NODE=M013W10

$83 \pm 9_{-4}^{+5}$ ¹ CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

50_{-22}^{+34} 84 ² CHEKANOV 04 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

¹In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

²Systematic errors not estimated.

NODE=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

 $f_2'(1525)$ DECAY MODES

NODE=M013215;NODE=M013

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	(88.8 \pm 2.2) %
Γ_2 $\eta\eta$	(10.3 \pm 2.2) %
Γ_3 $\pi\pi$	(8.2 \pm 1.5) $\times 10^{-3}$
Γ_4 $K\bar{K}^*(892) + \text{c.c.}$	
Γ_5 $\pi K\bar{K}$	
Γ_6 $\pi\pi\eta$	
Γ_7 $\pi^+\pi^+\pi^-\pi^-$	
Γ_8 $\gamma\gamma$	(1.12 \pm 0.15) $\times 10^{-6}$

DESIG=2

DESIG=4

DESIG=1

DESIG=3

DESIG=6

DESIG=5

DESIG=7

DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 2 partial widths, a combination of partial widths obtained from integrated cross sections, and 3 branching ratios uses 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 14.2$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-100			
x_3	-5	-1		
x_8	0	0	1	
Γ	-28	28	-1	-62
	x_1	x_2	x_3	x_8

Mode	Rate (MeV)
Γ_1 $K\bar{K}$	64 $_{-5}^{+6}$
Γ_2 $\eta\eta$	7.4 \pm 1.9
Γ_3 $\pi\pi$	0.59 \pm 0.12
Γ_8 $\gamma\gamma$	(8.1 \pm 0.9) $\times 10^{-5}$

DESIG=2

DESIG=4

DESIG=1

DESIG=8

 $f_2'(1525)$ PARTIAL WIDTHS

NODE=M013220

 $\Gamma(K\bar{K})$ **Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M013W6
 NODE=M013W6

 64_{-5}^{+6} OUR FIT

63_{-5}^{+6} ¹ LONGACRE 86 MPS $22 \pi^- p \rightarrow K_S^0 K_S^0 n$

¹From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

NODE=M013PW;LINKAGE=L

$\Gamma(\eta\eta)$ Γ_2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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7.4±1.9 OUR FIT

- • • We do not use the following data for averages, fits, limits, etc. • • •

5.0±0.8	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
24 $\begin{smallmatrix} +3 \\ -1 \end{smallmatrix}$		² LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f_2'(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

NODE=M013W7
NODE=M013W7

NODE=M013W7;LINKAGE=SC

NODE=M013PW7;LINKAGE=L

 $\Gamma(\pi\pi)$ Γ_3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.59±0.12 OUR FIT

1.4 $\begin{smallmatrix} +1.0 \\ -0.5 \end{smallmatrix}$		¹ LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
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- • • We do not use the following data for averages, fits, limits, etc. • • •

0.2 $\begin{smallmatrix} +1.0 \\ -0.2 \end{smallmatrix}$	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
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¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f_2'(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.

NODE=M013W5
NODE=M013W5

NODE=M013PW5;LINKAGE=L

NODE=M013W5;LINKAGE=SC

 $\Gamma(\gamma\gamma)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.081±0.009 OUR FIT

- • • We do not use the following data for averages, fits, limits, etc. • • •

0.13 ±0.03	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
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¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f_2'(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.

NODE=M013W8
NODE=M013W8

NODE=M013W8;LINKAGE=SC

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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- • • We do not use the following data for averages, fits, limits, etc. • • •

0.746±0.002 $\begin{smallmatrix} +0.166 \\ -0.162 \end{smallmatrix}$	¹ ALBRECHT 20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
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¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M013R00
NODE=M013R00

NODE=M013R00;LINKAGE=A

 $f_2'(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.072 ±0.007 OUR FIT**0.072 ±0.007 OUR AVERAGE**

0.048 $\begin{smallmatrix} +0.067 \\ -0.008 \end{smallmatrix}$ $\begin{smallmatrix} +0.108 \\ -0.012 \end{smallmatrix}$	UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
0.0564±0.0048±0.0116	ABE 04	BELL	10.6 $e^+e^- \rightarrow e^+e^- K^+K^-$
0.076 ±0.006 ±0.011	331 ACCIARRI 01H	L3	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.067 ±0.008 ±0.015	² ALBRECHT 90G	ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$ ±0.02	BEHREND 89c	CELL	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.10 $\begin{smallmatrix} +0.04 \\ -0.03 \end{smallmatrix}$ $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$	BERGER 88	PLUT	$e^+e^- \rightarrow e^+e^- K_S^0 K_S^0$
0.12 ±0.07 ±0.04	² AIHARA 86B	TPC	$e^+e^- \rightarrow e^+e^- K^+K^-$
0.11 ±0.02 ±0.04	² ALTHOFF 83	TASS	$e^+e^- \rightarrow e^+e^- K\bar{K}$

- • • We do not use the following data for averages, fits, limits, etc. • • •

0.0314±0.0050±0.0077	³ ALBRECHT 90G	ARG	$e^+e^- \rightarrow e^+e^- K^+K^-$
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¹ Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,

² Using an incoherent background.

³ Using a coherent background.

NODE=M013G1
NODE=M013G1

OCCUR=2

NODE=M013G;LINKAGE=HA

NODE=M013G1;LINKAGE=A

NODE=M013G1;LINKAGE=B

$f'_2(1525)$ BRANCHING RATIOS $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.059 ± 0.003 ± 0.026	¹ ALBRECHT 20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
seen	UEHARA 10A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \eta \eta$
0.10 ± 0.03	² PROKOSHKIN 91	GAM4 300	$\pi^- p \rightarrow \pi^- p \eta \eta$

¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

² Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013225

NODE=M013R8
NODE=M013R8

NODE=M013R8;LINKAGE=A

NODE=M013R8;LINKAGE=B

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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0.116 ± 0.028 OUR FIT**0.115 ± 0.028 OUR AVERAGE**

0.119 ± 0.015 ± 0.036	61	¹ BINON	07	GAMS	32.5 $K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$
0.11 ± 0.04		² PROKOSHKIN 91	GAM4 300		$\pi^- p \rightarrow \pi^- p \eta \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.14	90	BARBERIS	00E		450 $pp \rightarrow p_f \eta \eta p_s$
< 0.50		BARNES	67	HBC	4.6, 5.0 $K^- p$

¹ Using the compilation of the cross sections for $f'_2(1525)$ production in $K^- p$ collisions from ASTON 88D.

² Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013R3
NODE=M013R3

NODE=M013R3;LINKAGE=BI

NODE=M013R3;LINKAGE=B

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
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0.82 ± 0.16 OUR FIT**0.75 ± 0.16 OUR AVERAGE**

0.7 ± 0.2		COSTA	80	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
2.7 ^{+7.1} _{-1.3}		¹ GORLICH	80	ASPK	17, 18 $\pi^- p$
0.75 ± 0.25		^{1,2} MARTIN	79	RVUE	
3.4 ± 1.5 ± 1.0		³ ALBRECHT 20	RVUE		0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
< 6	95	AGUILAR-...	81B	HBC	4.2 $K^- p \rightarrow \Lambda K^+ K^-$
19 ± 3		CORDEN	79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
< 4.5	95	BARREIRO	77	HBC	4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$
1.2 ± 0.4		¹ PAWLICKI	77	SPEC	6 $\pi N \rightarrow K^+ K^- N$
< 6.3	90	BRANDENB...	76C	ASPK	13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
< 0.86		¹ BEUSCH	75B	OSPK	8.9 $\pi^- p \rightarrow K^0 \bar{K}^0 n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Assuming that the $f'_2(1525)$ is produced by an one-pion exchange production mechanism.

² MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f'_2(1525) \rightarrow K\bar{K}$ branching ratio.

³ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M013R1
NODE=M013R1

NODE=M013R1;LINKAGE=C

NODE=M013R1;LINKAGE=D

NODE=M013R1;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.0092 ± 0.0018 OUR FIT**0.075 ± 0.035**AUGUSTIN 87 DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$ NODE=M013R7
NODE=M013R7 $[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ $(\Gamma_4 + \Gamma_5)/\Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.35	95	AGUILAR-...	72B	HBC	3.9, 4.6 $K^- p$
< 0.4	67	AMMAR	67	HBC	

NODE=M013R5
NODE=M013R5

$\Gamma(\pi\pi\eta)/\Gamma(K\bar{K})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_1
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.41	95	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$
<0.3	67	AMMAR	67	HBC	

NODE=M013R4
NODE=M013R4

 $\Gamma(\pi^+\pi^+\pi^-\pi^-)/\Gamma(K\bar{K})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ_1
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.32	95	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$
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NODE=M013R6
NODE=M013R6

 $f'_2(1525)$ REFERENCES

NODE=M013

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
KLEMP	22	PL B830 137171	E. Klempt <i>et al.</i>	(BONN)	REFID=61646
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55137
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)	REFID=52057
		Translated from YAF 70 1758.			
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=49672
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARKOV	99	JETPL 70 248	B.P. Barkov <i>et al.</i>		REFID=47379
		Translated from ZETFP 70 242.			
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
ACCIARRI	95J	PL B363 118	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=44615
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BERGER	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=40566
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAITIS...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
BOLONKIN	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP	REFID=44646
		Translated from YAF 43 1211.			
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	83	PL 121B 216	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21408
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
AGUILAR-...	81B	ZPHY C8 313	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)	REFID=21104
ALHARRAN	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=21403
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20738
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
BARREIRO	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=21392
EVANGELIS...	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20540
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP	REFID=20367
BRANDENB...	76C	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)	REFID=20225
BEUSCH	75B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)	REFID=21390
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
AMMAR	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP	REFID=21382
BARNES	67	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC	REFID=21383
CRENNELL	66	PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I	REFID=20317

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Seen mostly in antinucleon-nucleon annihilation. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M123

NODE=M123

 $f_2(1565)$ T-MATRIX POLE \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M123PP

NODE=M123PP

NODE=M123PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1495–1560) – i (40–110) OUR ESTIMATE			
$(1560 \pm 15) - i(140 \pm 20)$	¹ ANISOVICH	09	RVUE 0.0 $\bar{p}p, \pi N$
$(1552 \pm 13) - i(57 \pm 12)$	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta,$ $\pi^0 \pi^0 \pi^0$
$(1507 \pm 15) - i(65 \pm 10)$	BERTIN	97C	OBLX 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
$(1534 \pm 20) - i(90 \pm 30)$	² ABELE	96C	RVUE Compilation
$(\sim 1552) - i(\sim 71)$	³ AMSLER	95D	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta \eta, \pi^0 \pi^0 \eta$

¹ On sheet II in a two-pole solution.

² T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.

³ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

NODE=M123PP;LINKAGE=A

NODE=M123PP;LINKAGE=D

NODE=M123PP;LINKAGE=E

 $f_2(1565)$ MASS

NODE=M123M

NODE=M123M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1571 ± 13 OUR AVERAGE			
1575 ± 18	¹ BERTIN	98	OBLX 0.05–0.405 $\bar{p}p \rightarrow \pi^+ \pi^+ \pi^-$
1565 ± 20	¹ MAY	90	ASTE 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1590 ± 10	AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
1550 ± 10 ± 20	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1598 ± 11 ± 9	BAKER	99B	SPEC 0 $\bar{p}p \rightarrow \omega \omega \pi^0$
1598 ± 72	BALOSHIN	95	SPEC 40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
1566 ⁺⁸⁰ ₋₅₀	² ANISOVICH	94	CBAR 0.0 $\bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0$
1502 ± 9	ADAMO	93	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1488 ± 10	³ ARMSTRONG	93C	E760 $\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1508 ± 10	³ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
1525 ± 10	³ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 1504	⁴ WEIDENAUER	93	ASTE 0.0 $\bar{p}N \rightarrow 3\pi^- 2\pi^+$
1540 ± 15	³ ADAMO	92	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1515 ± 10	⁵ AKER	91	CBAR 0.0 $\bar{p}p \rightarrow 3\pi^0$
1477 ± 5	BRIDGES	86C	DBC 0.0 $\bar{p}N \rightarrow 3\pi^- 2\pi^+$

OCCUR=2

¹ Breit-Wigner mass.

² From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

³ J^P not determined, could be partly $f_0(1500)$.

⁴ J^P not determined.

⁵ Superseded by AMSLER 95B.

NODE=M123M;LINKAGE=G

NODE=M123M;LINKAGE=C

NODE=M123M;LINKAGE=E

NODE=M123M;LINKAGE=F

NODE=M123M;LINKAGE=BA

 $f_2(1565)$ WIDTH

NODE=M123W

NODE=M123W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
132 ± 23 OUR AVERAGE Error includes scale factor of 1.1.			
119 ± 24	¹ BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
170 ± 40	¹ MAY	90	ASTE 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
140 ± 11	^{1,2} AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
130 ± 20 ± 40	¹ AMELIN	00	VES 37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
263 ± 101	BALOSHIN	95	SPEC 40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
166 ⁺⁸⁰ ₋₂₀	³ ANISOVICH	94	CBAR 0.0 $\bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0$
130 ± 10	⁴ ADAMO	93	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
148 ± 27	⁵ ARMSTRONG	93C	E760 $\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
103 ± 15	⁵ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$

111 ± 10	⁵ ARMSTRONG 93D	E760	$\bar{p}p \rightarrow \eta\pi^0\pi^0 \rightarrow 6\gamma$
~ 206	⁶ WEIDENAUER 93	ASTE	$0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$
132 ± 37	⁵ ADAMO	92	OBLX $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$
120 ± 10	⁷ AKER	91	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$
116 ± 9	BRIDGES	86C	DBC $0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$

OCCUR=2

¹ Breit-Wigner width.² Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.³ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$ including AKER 91 data.⁴ Supersedes ADAMO 92.⁵ J^P not determined, could be partly $f_0(1500)$.⁶ J^P not determined.⁷ Superseded by AMSLER 95B.

NODE=M123W;LINKAGE=G
 NODE=M123W;LINKAGE=AM
 NODE=M123W;LINKAGE=D

NODE=M123W;LINKAGE=C
 NODE=M123W;LINKAGE=E
 NODE=M123W;LINKAGE=F
 NODE=M123W;LINKAGE=BA

 $f_2(1565)$ DECAY MODES

NODE=M123215;NODE=M123

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\pi^+\pi^-$	seen
Γ_3 $\pi^0\pi^0$	seen
Γ_4 $\rho^0\rho^0$	seen
Γ_5 $2\pi^+ 2\pi^-$	seen
Γ_6 $\eta\eta$	seen
Γ_7 $\omega\omega$	seen
Γ_8 $K\bar{K}$	seen
Γ_9 $\gamma\gamma$	seen

DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←

 $f_2(1565)$ PARTIAL WIDTHS

NODE=M123225

 $\Gamma(\eta\eta)$ **Γ_6**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M123W3
 NODE=M123W3

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1.2 ± 0.3	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
-----------	-----	-----------------------------	------	--

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

NODE=M123W3;LINKAGE=SC

 $\Gamma(K\bar{K})$ **Γ_8**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

NODE=M123W1
 NODE=M123W1

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

2.0 ± 1.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
-----------	-----	-----------------------------	------	--

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

NODE=M123W1;LINKAGE=SC

 $\Gamma(\gamma\gamma)$ **Γ_9**

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

NODE=M123W2
 NODE=M123W2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

0.70 ± 0.14	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
-------------	-----	-----------------------------	------	--

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

NODE=M123W2;LINKAGE=SC

 $f_2(1565)$ BRANCHING RATIOS

NODE=M123220

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M123R5
 NODE=M123R5

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

seen	BAKER	99B	SPEC $0 \bar{p}p \rightarrow \omega\omega\pi^0$
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$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
-------	-------------	------	---------	-------------------

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	BERTIN	98	OBLX	0.05–0.405 $\bar{n}p \rightarrow \pi^+\pi^+\pi^-$	
not seen	¹ ANISOVICH	94B	RVUE	$\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
seen	MAY	89	ASTE	$\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	

¹ ANISOVICH 94B is from a reanalysis of MAY 90.

NODE=M123R1
NODE=M123R1

NODE=M123R1;LINKAGE=A

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
-------	-------------	------	---------	-------------------

seen	AMSLER	95B	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$	
------	--------	-----	------	-----------------------------------	--

NODE=M123R3
NODE=M123R3

 $\Gamma(\pi^+\pi^-)/\Gamma(\rho^0\rho^0)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_4
-------	-------------	------	---------	---------------------

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.042±0.013	BRIDGES	86B	DBC	$\bar{p}N \rightarrow 3\pi^-2\pi^+$	
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NODE=M123R2
NODE=M123R2

 $\Gamma(\eta\eta)/\Gamma(\pi^0\pi^0)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_3
-------	-------------	------	---------	---------------------

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.024±0.005±0.012	¹ ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$	
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¹ J^P not determined, could be partly $f_0(1500)$.

NODE=M123R4
NODE=M123R4

NODE=M123R4;LINKAGE=E

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ
-------	-------------	------	---------	-------------------

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	BAKER	99B	SPEC	0 $\bar{p}p \rightarrow \omega\omega\pi^0$	
------	-------	-----	------	--	--

NODE=M123R6
NODE=M123R6

 $f_2(1565)$ REFERENCES

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
		Translated from YAF 69 715.			
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
BAKER	99B	PL B467 147	C.A. Baker <i>et al.</i>		REFID=47398
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45076
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44440
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)	REFID=44621
		Translated from YAF 58 50.			
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
ANISOVICH	94B	PR D50 1972	V.V. Anisovich <i>et al.</i>	(LOQM)	REFID=44071
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.)	REFID=43657
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43596
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)	REFID=42177
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42172
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
MAY	90	ZPHY C46 203	B. May <i>et al.</i>	(ASTERIX Collab.)	REFID=41365
MAY	89	PL B225 450	B. May <i>et al.</i>	(ASTERIX Collab.) IJP	REFID=40921
BRIDGES	86B	PRL 56 215	D.L. Bridges <i>et al.</i>	(SYRA, CASE)	REFID=21376
BRIDGES	86C	PRL 57 1534	D.L. Bridges <i>et al.</i>	(SYRA)	REFID=21377

NODE=M123

$\rho(1570)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M188

NODE=M188

 $\rho(1570)$ MASS

NODE=M188M

NODE=M188M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1570±36±62	54	¹ AUBERT	08S BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
••• We do not use the following data for averages, fits, limits, etc. •••				
1614±2		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
1585±15		³ ACHASOV	20C SND	1.3–2.0 $e^+e^- \rightarrow K^+K^-\pi^0$
1480±40		⁴ BITYUKOV	87 SPEC	32.5 $\pi^-p \rightarrow \phi\pi^0n$

¹ From the fit with two resonances.² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.³ From a fit using a two resonance model in which the mass and width of the other resonance are fixed at the $\rho(1700)$ values from PDG 20.⁴ Systematic errors not estimated.NODE=M188M;LINKAGE=AU
NODE=M188M;LINKAGE=B

NODE=M188M;LINKAGE=A

NODE=M188M;LINKAGE=BI

 $\rho(1570)$ WIDTH

NODE=M188W

NODE=M188W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
144±75±43	54	¹ AUBERT	08S BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
••• We do not use the following data for averages, fits, limits, etc. •••				
492±4		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
75±30		³ ACHASOV	20C SND	1.3–2.0 $e^+e^- \rightarrow K^+K^-\pi^0$
130±60		⁴ BITYUKOV	87 SPEC	32.5 $\pi^-p \rightarrow \phi\pi^0n$

¹ From the fit with two resonances.² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.³ From a fit using a two resonance model in which the mass and width of the other resonance are fixed at the $\rho(1700)$ values from PDG 20.⁴ Systematic errors not estimated.NODE=M188W;LINKAGE=AU
NODE=M188W;LINKAGE=B

NODE=M188W;LINKAGE=A

NODE=M188W;LINKAGE=BI

 $\rho(1570)$ DECAY MODES

NODE=M188215;NODE=M188

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	seen
Γ_2 $\phi\pi$	not seen
Γ_3 $\omega\pi$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=3

 $\rho(1570)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M188225

$\Gamma(\phi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
3.5±0.9±0.3	54	¹ AUBERT	08S BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
••• We do not use the following data for averages, fits, limits, etc. •••				
<70	90	² AULCHENKO	87B ND	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$

¹ From the fit with two resonances.² Using mass and width of BITYUKOV 87.

NODE=M188G01;LINKAGE=AU

NODE=M188G01;LINKAGE=AL

 $\rho(1570)$ BRANCHING RATIOS

NODE=M188220

$\Gamma(\phi\pi)/\Gamma_{\text{total}}$		Γ_2/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABELE	97H CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
••• We do not use the following data for averages, fits, limits, etc. •••			
<0.01	¹ DONNACHIE	91 RVUE	

¹ Using data from BISELLO 91B, DOLINSKY 86, and ALBRECHT 87L.

NODE=M188R01

NODE=M188R01

NODE=M188R01;LINKAGE=DO

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$ Γ_2/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M188R02
 NODE=M188R02

••• We do not use the following data for averages, fits, limits, etc. •••

>0.5	95	BITYUKOV	87	SPEC	32.5 $\pi^- p \rightarrow \phi\pi^0 n$
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 $\rho(1570)$ REFERENCES

NODE=M188

ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=62428
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61028
ACHASOV	20C	EPJ C80 1139	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60935
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58311
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45765
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41373
		Translated from ZETFP	45 118.		
BITYUKOV	87	PL B188 383	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=40011
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246

NODE=M166

 $h_1(1595)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

OMITTED FROM SUMMARY TABLE

Seen in a partial-wave analysis of the $\omega\eta$ system produced in the reaction $\pi^- p \rightarrow \omega\eta n$ at 18 GeV/c.

NODE=M166

 $h_1(1595)$ MASS

NODE=M166M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166M

 $h_1(1595)$ WIDTH

NODE=M166W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$384 \pm 60^{+70}_{-100}$	EUGENIO	01	SPEC 18 $\pi^- p \rightarrow \omega\eta n$

NODE=M166W

 $h_1(1595)$ DECAY MODES

NODE=M166215;NODE=M166

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega\eta$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

 $h_1(1595)$ REFERENCES

NODE=M166

EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>
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REFID=48010

$\pi_1(1600)$

$$I^G(J^{PC}) = 1^-(1^-+)$$

Coupled channel analyses favor the existence of only one broad 1^-+ isovector state consistent with $\pi_1(1600)$ in the 1400–1600 MeV region. Accordingly, the $\pi_1(1400)$ entries of the previous Reviews have been moved into this section. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M164

NODE=M164

 $\pi_1(1600)$ T-Matrix Pole \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M164TMP

NODE=M164TMP

NODE=M164TMP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1480–1680) – i (150–300) OUR ESTIMATE			
$(1623 \pm 47^{+24}_{-75}) - i(228 \pm 44^{+72}_{-88})$	¹ KOPF	21	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$ and $191 \pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$
$(1564 \pm 24 \pm 86) - i(246 \pm 27 \pm 51)$	² RODAS	19	RVUE $191 \pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1405 \pm 4^{+15}_{-18}) - i(314 \pm 14^{+18}_{-69})$	³ ALBRECHT	20	RVUE $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.			
² The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data.			
³ Superseded by KOPF 21.			

NODE=M164TMP;LINKAGE=B

NODE=M164TMP;LINKAGE=A
NODE=M164TMP;LINKAGE=AL **$\pi_1(1600)$ MASS ($\eta\pi$ mode)**

Not seen by PROKOSHKIN 95B, BUGG 94, APEL 81, BOUTEMEUR 90, and AGHASYAN 18B.

NODE=M164MEP

NODE=M164MEP

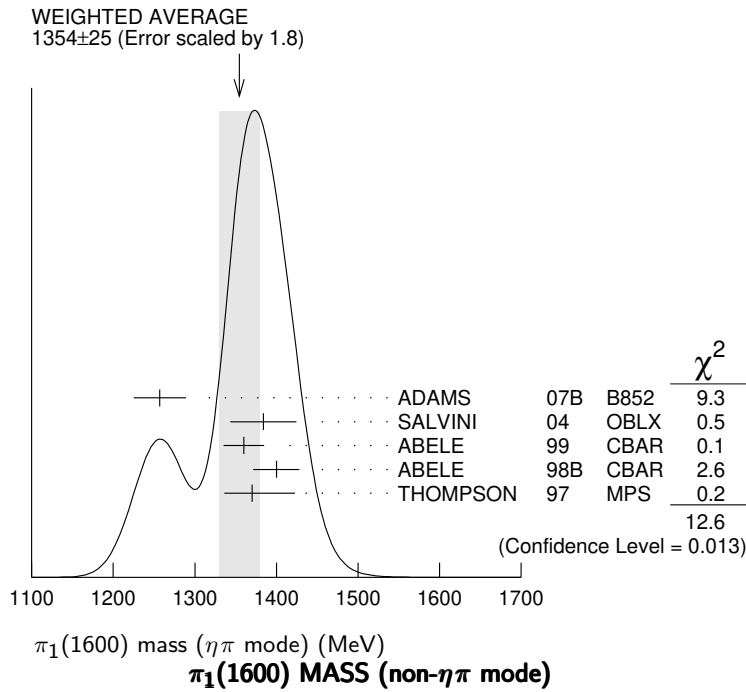
NODE=M164MEP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ±25	OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.			
$1257 \pm 20 \pm 25$	23.5k	ADAMS	07B	B852	$18 \pi^- p \rightarrow \eta \pi^0 n$
$1384 \pm 20 \pm 35$	90k	SALVINI	04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ± 25		ABELE	99	CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$1400 \pm 20 \pm 20$		ABELE	98B	CBAR	$0.0 \bar{p}n \rightarrow \pi^- \pi^0 \eta$
1370 ± 16	$^{+50}_{-30}$	¹ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1323.1 ± 4.6		² AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
1406 ± 20		³ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$
¹ Natural parity exchange, questioned by DZIERBA 03.					
² Unnatural parity exchange.					
³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.					

NODE=M164MEP;LINKAGE=B

NODE=M164MEP;LINKAGE=C

NODE=M164MEP;LINKAGE=A



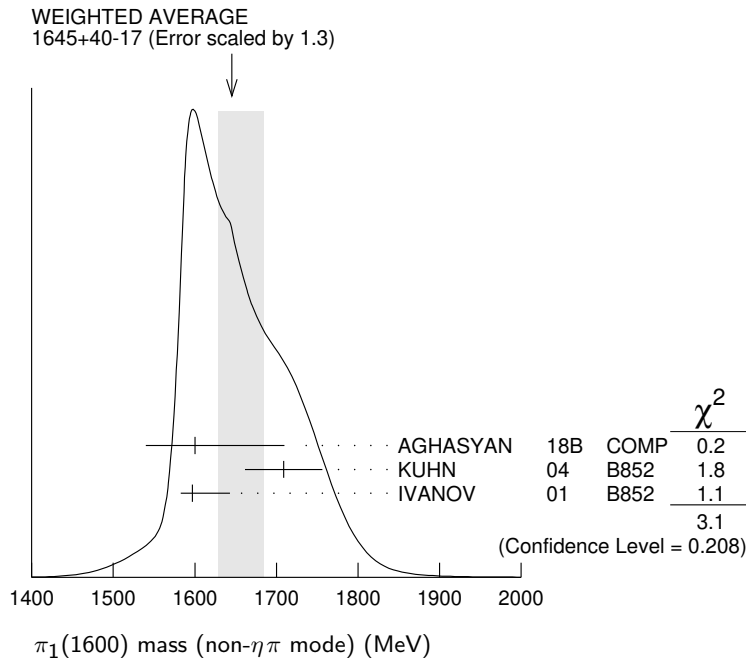
NODE=M164M

NODE=M164M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1645⁺⁴⁰₋₁₇ OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
1600 ⁺¹¹⁰ ₋₆₀	46M	1 AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1709 ± 24 ± 41	69k	2 KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1597 ± 10 ⁺⁴⁵ ₋₁₀		2 IVANOV	01 B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1660 ± 10 ⁺⁰ ₋₆₄	420k	3 ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1664 ± 8 ± 10	145k	4 LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1593 ± 8 ⁺²⁹ ₋₄₇		2,5 ADAMS	98B B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M164M;LINKAGE=B
 NODE=M164M;LINKAGE=A
 NODE=M164M;LINKAGE=C
 NODE=M164M;LINKAGE=LU
 NODE=M164M;LINKAGE=DZ

¹ Statistical error negligible. See also the review ALEXEEV 22.
² Natural parity exchange.
³ Superseded by AGHASYAN 2018B.
⁴ May be a different state: natural and unnatural parity exchanges.
⁵ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.



$\pi_1(1600)$ WIDTH ($\eta\pi$ mode)

Not seen by PROKOSHKIN 95B, BUGG 94, APEL 81, BOUTEMEUR 90, and AGHASYAN 18B.

NODE=M164WEP

NODE=M164WEP

NODE=M164WEP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 ± 35	OUR AVERAGE				
354 ± 64 ± 58	23.5k	ADAMS	07B	B852	18 $\pi^- p \rightarrow \eta\pi^0 n$
378 ± 50 ± 50	90k	SALVINI	04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
220 ± 90		ABELE	99	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\eta$
310 ± 50 + 50 - 30		ABELE	98B	CBAR	0.0 $\bar{p}n \rightarrow \pi^- \pi^0\eta$
385 ± 40 + 65 - 105		¹ THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

143.2 ± 12.5		² AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta\pi^- p$
180 ± 20		³ ALDE	88B	GAM4 0	100 $\pi^- p \rightarrow \eta\pi^0 n$

¹ Resolution is not unfolded, natural parity exchange, questioned by DZIERBA 03.

² Unnatural parity exchange.

³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M164WEP;LINKAGE=QQ

NODE=M164WEP;LINKAGE=C

NODE=M164WEP;LINKAGE=A

NODE=M164W

$\pi_1(1600)$ WIDTH (non- $\eta\pi$ mode)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
370 + 50 - 60	OUR AVERAGE			
580 + 100 - 230	46M	¹ AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
403 ± 80 ± 115	69k	² KUHN	04	B852 18 $\pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$
340 ± 40 ± 50		² IVANOV	01	B852 18 $\pi^- p \rightarrow \eta' \pi^- p$
269 ± 21 + 42 - 64	420k	³ ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
185 ± 25 ± 28	145k	⁴ LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^- \pi^0 p$
168 ± 20 + 150 - 12		^{2,5} ADAMS	98B	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ Statistical error negligible. See also the review ALEXEEV 22.

² Natural parity exchange.

³ Superseded by AGHASYAN 2018B.

⁴ May be a different state: natural and unnatural parity exchanges.

⁵ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164W

NODE=M164W;LINKAGE=B

NODE=M164W;LINKAGE=A

NODE=M164W;LINKAGE=C

NODE=M164W;LINKAGE=LU

NODE=M164W;LINKAGE=DZ

$\pi_1(1600)$ DECAY MODES

NODE=M164215;NODE=M164

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi\pi$	seen
Γ_2 $\rho^0\pi^-$	seen
Γ_3 $f_2(1270)\pi^-$	not seen
Γ_4 $b_1(1235)\pi$	seen
Γ_5 $\eta'(958)\pi^-$	seen
Γ_6 $\eta\pi$	seen
Γ_7 $f_1(1285)\pi$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2
DESIG=4
DESIG=5
DESIG=3
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←

 $\pi_1(1600)$ BRANCHING RATIOS

NODE=M164220

$\Gamma(\rho^0\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ALEKSEEV 10 COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen NOZAR 09 CLAS $\gamma p \rightarrow 2\pi^+ \pi^- n$

not seen ¹ DZIERBA 06 B852 18 $\pi^- p$

¹ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes ADAMS 98B.

NODE=M164R1
NODE=M164R1

NODE=M164R1;LINKAGE=DZ

$\Gamma(f_2(1270)\pi^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen ¹ DZIERBA 06 B852 18 $\pi^- p$

¹ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes CHUNG 02.

NODE=M164R3
NODE=M164R3

NODE=M164R3;LINKAGE=DZ

$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

seen 35280 ¹ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 145k LU 05 B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$

¹ $B((b_1\pi)_{D\text{-wave}})/B((b_1\pi)_{S\text{-wave}})=0.3 \pm 0.1$.

NODE=M164R4
NODE=M164R4

NODE=M164R;LINKAGE=RB

$\Gamma(\eta'(958)\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen IVANOV 01 B852 18 $\pi^- p \rightarrow \eta'\pi^- p$

NODE=M164R2
NODE=M164R2

$\Gamma(\eta'(958)\pi^-)/\Gamma(\eta\pi)$ Γ_5/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.54 \pm 1.1^{+1.8}_{-0.27}$ ¹ KOPF 21 RVUE 0.9 $p\bar{p} \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$
 $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$
 $\pi^- \pi^- \pi^+ p$

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

NODE=M164R00
NODE=M164R00

NODE=M164R00;LINKAGE=A

$\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$ Γ_7/Γ_5

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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3.80 ± 0.78 69k ¹ KUHN 04 B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

¹ Using $\eta'(958)\pi$ data from IVANOV 01.

NODE=M164R5
NODE=M164R5

NODE=M164R;LINKAGE=KU

$\pi_1(1600)$ REFERENCES

ALEXEEV	22	PR D105 012005	G.D. Alexeev <i>et al.</i>	(COMPASS Collab.)	NODE=M164
KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)	REFID=61491
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=61470
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=60439
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59554
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=59471
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=56385
NOZAR	09	PRL 102 102002	M. Nozar <i>et al.</i>	(JLab CLAS Collab.)	REFID=53356
ADAMS	07B	PL B657 27	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=52758
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)	REFID=52048
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)	REFID=51077
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)	REFID=50459
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)	REFID=49773
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>		REFID=53226
DZIERBA	03	PR D67 094015	A.R. Dzierba <i>et al.</i>		REFID=49414
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=49412
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
ABELE	99	PL B446 349	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48317
ABELE	98B	PL B423 175	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46602
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=45864
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)	REFID=46610
PROKOSHKIN	95B	PAN 58 606	Y.D. Prokoshkin, S.A. Sadovsky	(SERP)	REFID=45584
		Translated from YAF 58 662.			REFID=44619
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)	REFID=43599
BOUTEMEUR	90	Hadron 89 Conf. p 119	M. Boutemur, M. Poulet	(SERP, BELG, LANL+)	REFID=41751
ALDE	88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=40558
APEL	81	NP B193 269	W.D. Apel <i>et al.</i>	(SERP, CERN)	REFID=22913

 $a_1(1640)$

$$I^G(J^{PC}) = 1^-(1^{++})$$

Possibly seen in the study of the hadronic structure in decay $\tau \rightarrow 3\pi\nu_\tau$ (ABREU 98G and ASNER 00).

 $a_1(1640)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1655 ± 16 OUR AVERAGE		Error includes scale factor of 1.2.		
1700 ⁺³⁵ ₋₁₃₀	46M	¹ AGHASYAN 18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1691 ± 18 ± 30		DARGENT 17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1630 ± 20	35k	² BAKER 03	SPEC	$\bar{p} p \rightarrow \omega \pi^+ \pi^- \pi^0$
1714 ± 9 ± 36		CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1640 ± 12 ± 30		BAKER 99	SPEC	1.94 $\bar{p} p \rightarrow 4\pi^0$
1670 ± 90		BELLINI 85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

¹Statistical error negligible.²Using the $a_1(1260)$ mass and width results of BOWLER 88. $a_1(1640)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
250 ± 40 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
510 ⁺¹⁷⁰ ₋₉₀	46M	¹ AGHASYAN 18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
171 ± 33 ± 40		DARGENT 17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
225 ± 30	35k	² BAKER 03	SPEC	$\bar{p} p \rightarrow \omega \pi^+ \pi^- \pi^0$
308 ± 37 ± 62		CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
300 ± 22 ± 40		BAKER 99	SPEC	1.94 $\bar{p} p \rightarrow 4\pi^0$
300 ± 100		BELLINI 85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M161

NODE=M161

NODE=M161M

NODE=M161M

NODE=M161M;LINKAGE=A

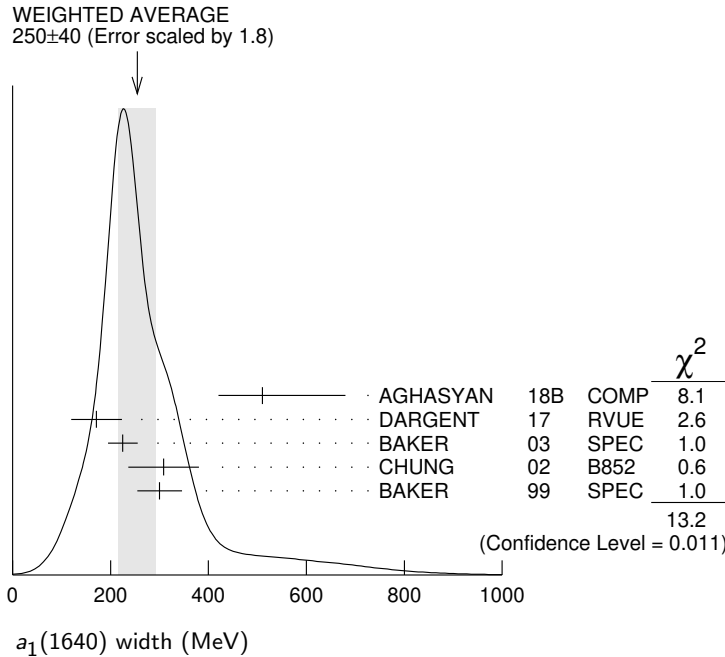
NODE=M161M;LINKAGE=KB

NODE=M161W

NODE=M161W

- ¹ Statistical error negligible.
- ² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161W;LINKAGE=A
 NODE=M161W;LINKAGE=KB



$a_1(1640)$ DECAY MODES

NODE=M161215;NODE=M161

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi\pi$	seen
Γ_2 $f_2(1270)\pi$	seen
Γ_3 $\sigma\pi$	seen
Γ_4 $\rho\pi S\text{-wave}$	seen
Γ_5 $\rho\pi D\text{-wave}$	seen
Γ_6 $\omega\pi\pi$	seen
Γ_7 $f_1(1285)\pi$	seen
Γ_8 $a_1(1260)\eta$	not seen

DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8

$a_1(1640)$ BRANCHING RATIOS

NODE=M161220

$\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$					Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	COMMENT		
0.24±0.07	BAKER	99	SPEC	1.94 $\bar{p}p \rightarrow 4\pi^0$	

NODE=M161R1
 NODE=M161R1

$\Gamma(\rho\pi D\text{-wave})/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		

NODE=M161R2
 NODE=M161R2

- • • We do not use the following data for averages, fits, limits, etc. • • •
- seen CHUNG 02 B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
- seen AMELIN 95B VES 36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M161R3
 NODE=M161R3

- • • We do not use the following data for averages, fits, limits, etc. • • •
- seen 35280 ¹ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

¹ Assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M161R;LINKAGE=KB

$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		

NODE=M161R4
 NODE=M161R4

- • • We do not use the following data for averages, fits, limits, etc. • • •
- not seen KUHN 04 B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
- seen LEE 94 MPS2 18 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

$\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M161R5
 NODE=M161R5

 $a_1(1640)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
DARGENT	17	JHEP 1705 143	P. d'Argent <i>et al.</i>	(HEID, BRIS)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	(DELPHI Collab.)
ABREU	98G	PL B426 411	P. Abreu <i>et al.</i>	(SERP, TBIL)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(BNL, IND, KYUN, MASD+)
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(OXF)
BOWLER	88	PL B209 99	M.G. Bowler	
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	

Translated from YAF 41 1223.

NODE=M161

REFID=59471
 REFID=58121
 REFID=49773
 REFID=49414
 REFID=48837
 REFID=47339
 REFID=46888
 REFID=45909
 REFID=44433
 REFID=44092
 REFID=40578
 REFID=47490

NODE=M117

 $f_2(1640)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

 $f_2(1640)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639 ± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620 ± 16	BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647 ± 7	ADAMO	92 OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
1635 ± 7	ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega \omega n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1640 ± 5	AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659 ± 6	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1643 ± 7	¹ ALDE	89B GAM2	$38 \pi^- p \rightarrow \omega \omega n$

¹Superseded by ALDE 90.

NODE=M117M

NODE=M117M

NODE=M117M;LINKAGE=BB

 $f_2(1640)$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
100⁺⁶⁰₋₄₀ OUR AVERAGE		Error includes scale factor of 2.9.		
140 ⁺⁶⁰ ₋₂₀		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
58 ± 20		ADAMO	92 OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
44 ± 9		AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
152 ± 18		VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
< 70	90	ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega \omega n$

NODE=M117W

NODE=M117W

 $f_2(1640)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega\omega$	seen
Γ_2 4π	seen
Γ_3 $K\bar{K}$	seen

NODE=M117215;NODE=M117

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3

 $f_2(1640)$ BRANCHING RATIOS $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M117220

NODE=M117R2
 NODE=M117R2

 $f_2(1640)$ REFERENCES

AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
Translated from YAF 69 515.				
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH) JP
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	89B	PL B216 451	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+) IGJPC

NODE=M117

REFID=51136
 REFID=51191
 REFID=44438
 REFID=42177
 REFID=40935
 REFID=40735

$\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M154

 $\eta_2(1645)$ MASS

NODE=M154M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1617± 5 OUR AVERAGE				
1613± 8	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1617± 8	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
1620±20	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1645±14±15	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1645± 6±20	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154M

 $\eta_2(1645)$ WIDTH

NODE=M154W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
181±11 OUR AVERAGE				
185±17	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
177±18	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
180±25	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
180 ⁺⁴⁰ ₋₂₁ ±25	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200±25	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154W

 $\eta_2(1645)$ DECAY MODES

NODE=M154215;NODE=M154

Mode	Fraction (Γ_i/Γ)
Γ_1 $a_2(1320)\pi$	seen
Γ_2 $K\bar{K}\pi$	seen
Γ_3 $K^*\bar{K}$	seen
Γ_4 $\eta\pi^+\pi^-$	seen
Γ_5 $a_0(980)\pi$	seen
Γ_6 $f_2(1270)\eta$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←

 $\eta_2(1645)$ BRANCHING RATIOS

NODE=M154220

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
0.07±0.03	¹ BARBERIS	97C	OMEG 450 $pp \rightarrow ppK\bar{K}\pi$	

NODE=M154R1
NODE=M154R1

¹ Using $2(\pi^+\pi^-)$ data from BARBERIS 97B.

NODE=M154R1;LINKAGE=A

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_5
13.1±2.3 OUR AVERAGE				
13.5±4.6	² ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$	
13.0±2.7	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$	

NODE=M154R3
NODE=M154R3

² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M154R3;LINKAGE=AN

VALUE	DOCUMENT ID	COMMENT	Γ_6/Γ
not seen	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$	

NODE=M154R4
NODE=M154R4

 $\eta_2(1645)$ REFERENCES

NODE=M154

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)	REFID=53631
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>		REFID=47945
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47958
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45202

$\omega(1650)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

See also the $\omega(1420)$ particle listing.

NODE=M126

NODE=M126

NODE=M126M

NODE=M126M

→ UNCHECKED ←

 $\omega(1650)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1670 ± 30 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1660.0 ± 8.4		¹ LICHARD	23 RVUE	$e^+e^- \rightarrow \omega\eta$
1698 ± 10	267	² ACHASOV	20B SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
1651 ± 3 ⁺¹⁶ / ₋₆	183k	³ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+K^-\pi^0$
1673 ⁺⁶ / ₋₇		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
1671 ± 6 ± 10	824	⁴ AKHMETSHIN	17A CMD3	$1.4-2.0 e^+e^- \rightarrow \omega\eta$
1660 ± 10	898	⁵ ACHASOV	16B SND	$1.34-2.00 e^+e^- \rightarrow \omega\eta$
1680 ± 10	13.1k	⁶ AULCHENKO	15A SND	$1.05-1.80 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1667 ± 13 ± 6		AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1645 ± 8	13	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow \omega\eta\gamma$
1660 ± 10 ± 2		AUBERT,B	04N BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1770 ± 50 ± 60	1.2M	⁷ ACHASOV	03D RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1619 ± 5		⁸ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1700 ± 20		EUGENIO	01 SPEC	$18 \pi^-p \rightarrow \omega\eta n$
1705 ± 26	612	⁹ AKHMETSHIN	00D CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1820 ⁺¹⁹⁰ / ₋₁₅₀		¹⁰ ACHASOV	98H RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1840 ⁺¹⁰⁰ / ₋₇₀		¹¹ ACHASOV	98H RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1780 ⁺¹⁷⁰ / ₋₃₀₀		¹² ACHASOV	98H RVUE	$e^+e^- \rightarrow K^+K^-$
~ 2100		¹³ ACHASOV	98H RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1606 ± 9		¹⁴ CLEGG	94 RVUE	
1662 ± 13	750	¹⁵ ANTONELLI	92 DM2	$1.34-2.4 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1670 ± 20		ATKINSON	83B OMEG	$20-70 \gamma p \rightarrow 3\pi X$
1657 ± 13		CORDIER	81 DM1	$e^+e^- \rightarrow \omega 2\pi$
1679 ± 34	21	ESPOSITO	80 FRAM	$e^+e^- \rightarrow 3\pi$
1652 ± 17		COSME	79 OSPK	$e^+e^- \rightarrow 3\pi$

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

NODE=M126M;LINKAGE=J

NODE=M126M;LINKAGE=H

NODE=M126M;LINKAGE=G

NODE=M126M;LINKAGE=F

NODE=M126M;LINKAGE=E

NODE=M126M;LINKAGE=A

NODE=M126M;LINKAGE=VH

NODE=M126M;LINKAGE=AB

NODE=M126M;LINKAGE=KI

NODE=M126M;LINKAGE=L1

NODE=M126M;LINKAGE=L2

NODE=M126M;LINKAGE=L3

NODE=M126M;LINKAGE=L4

NODE=M126M;LINKAGE=AD

¹ From a VDM fit to AKHMETSHIN 17A $\omega\eta$ data with two additional resonances of low statistical evidences.

² From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in 1694 ± 9 MeV measurement.

³ Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

⁴ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.

⁵ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁶ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

⁷ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁸ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

⁹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

¹⁰ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

¹¹ Using the data from ANTONELLI 92.

¹² Using the data from IVANOV 81 and BISELLO 88B.

¹³ Using the data from BISELLO 91C.

¹⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹⁵ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

NODE=M126M;LINKAGE=AE

$\omega(1650)$ WIDTH

NODE=M126W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
315 ± 35 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
106 ± 15		¹ LICHARD 23	RVUE	$e^+e^- \rightarrow \omega\eta$
110 ± 16	267	² ACHASOV 20B	SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
194 ± 8 ⁺ ₇ ¹⁵	183k	³ ABLIKIM 19AQ	BES	$J/\psi \rightarrow K^+K^-\pi^0$
95 ± 11		ACHASOV 19	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
113 ± 9 ± 10	824	⁴ AKHMETSHIN 17A	CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
110 ± 20	898	⁵ ACHASOV 16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
310 ± 30	13.1k	⁶ AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
222 ± 25 ± 20		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
114 ± 14	13	AUBERT 06D	BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
230 ± 30 ± 20		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
490 ⁺ ₁₅₀ ²⁰⁰ ± 130	1.2M	⁷ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
250 ± 14		⁸ HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
250 ± 50		EUGENIO 01	SPEC	18 $\pi^-p \rightarrow \omega\eta n$
370 ± 25	612	⁹ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
113 ± 20		¹⁰ CLEGG 94	RVUE	
280 ± 24	750	¹¹ ANTONELLI 92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
160 ± 20		ATKINSON 83B	OMEG	20–70 $\gamma p \rightarrow 3\pi X$
136 ± 46		CORDIER 81	DM1	$e^+e^- \rightarrow \omega 2\pi$
99 ± 49	21	ESPOSITO 80	FRAM	$e^+e^- \rightarrow 3\pi$
42 ± 17		COSME 79	OSPK	$e^+e^- \rightarrow 3\pi$

NODE=M126W

→ UNCHECKED ←

OCCUR=2

OCCUR=5

OCCUR=4

¹ From a VDM fit to AKHMETSHIN 17A $\omega\eta$ data with two additional resonances of low statistical evidences.

² From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in 94 ± 13 MeV measurement.

³ Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

⁴ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.

⁵ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁶ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

⁷ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁸ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

⁹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

¹⁰ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹¹ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

NODE=M126W;LINKAGE=J

NODE=M126W;LINKAGE=H

NODE=M126W;LINKAGE=G

NODE=M126W;LINKAGE=F

NODE=M126W;LINKAGE=E

NODE=M126W;LINKAGE=A

NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

$\omega(1650)$ DECAY MODES

NODE=M126215;NODE=M126

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\rho(1450)\pi$	seen
Γ_3 $\omega\pi\pi$	seen
Γ_4 $\omega\eta$	seen
Γ_5 e^+e^-	seen
Γ_6 $\pi^0\gamma$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=6

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=5

$\omega(1650) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M126230

 $\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma \times \Gamma_5/\Gamma$ NODE=M126G3
NODE=M126G3

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.56 ± 0.23	13.1k	¹ AULCHENKO	15A SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1.3 ± 0.1 ± 0.1		AUBERT,B	04N BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1.2 $^{+0.4}_{-0.1}$ ± 0.8	1.2M	^{2,3} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.921 ± 0.230		^{4,5} CLEGG	94 RVUE	
0.479 ± 0.050	750	^{6,7} ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

² Calculated by us from the cross section at the peak.

³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁵ From the partial and leptonic width given by the authors.

⁶ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

⁷ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M126G3;LINKAGE=A

NODE=M126G;LINKAGE=AW
NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
NODE=M126G;LINKAGE=AE
NODE=M126G;LINKAGE=ES $\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_5/\Gamma$ NODE=M126G4
NODE=M126G4

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
7.0 ± 0.5		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
4.1 ± 0.9 ± 1.3	1.2M	^{1,2} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.40 ± 0.95		³ AKHMETSHIN	00D CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
3.18 ± 0.80		^{4,5} CLEGG	94 RVUE	
6.07 ± 0.61	750	^{6,7} ANTONELLI	92 DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ Calculated by us from the cross section at the peak.

² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

³ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁵ From the partial and leptonic width given by the authors.

⁶ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

⁷ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M126G4;LINKAGE=AW
NODE=M126G4;LINKAGE=VH

NODE=M126G4;LINKAGE=KL

NODE=M126G4;LINKAGE=AD

NODE=M126G4;LINKAGE=SE
NODE=M126G4;LINKAGE=AE
NODE=M126G4;LINKAGE=ES $\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_5/\Gamma$ NODE=M126G5
NODE=M126G5

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
6.4 ± 0.9	267	¹ ACHASOV	20B SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
5.62 $^{+0.45}_{-0.42}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
4.5 ± 0.3 ± 0.3	824	² AKHMETSHIN	17A CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
4.4 ± 0.5	898	³ ACHASOV	16B SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
5.7 ± 0.6	13	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
< 60 at 90% CL		⁴ AKHMETSHIN	03B CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in $(5.4 \pm 0.6) \times 10^{-7}$ measurement.

² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating. From an alternative fit $\Gamma(\omega(1650) \rightarrow \omega\eta)/\Gamma_{\text{total}} \times \Gamma(\omega(1650) \rightarrow e^+e^-) = 51 \pm 3$ eV.

³ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁴ $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively.

NODE=M126G5;LINKAGE=C

NODE=M126G5;LINKAGE=B

NODE=M126G5;LINKAGE=A
NODE=M126G5;LINKAGE=KH

$\omega(1650)$ BRANCHING RATIOS $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.65	1.2M	¹ ACHASOV	03D	RVUE $0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 ± 0.014		² HENNER	02	RVUE $1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

² Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126225

NODE=M126R3
NODE=M126R3

NODE=M126R;LINKAGE=VH

NODE=M126R;LINKAGE=AC

 $\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ACHASOV 20A SND $1.15-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$

NODE=M126R02
NODE=M126R02 $\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.35	1.2M	¹ ACHASOV	03D	RVUE $0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 ± 0.014		² HENNER	02	RVUE $1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

² Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R2
NODE=M126R2

NODE=M126R2;LINKAGE=VH

NODE=M126R2;LINKAGE=AC

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 18	1.2M	^{1,2} ACHASOV	03D	RVUE $0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
32 ± 1		² HENNER	02	RVUE $1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ Calculated by us from the cross section at the peak.

² Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R4
NODE=M126R4NODE=M126R;LINKAGE=AW
NODE=M126R4;LINKAGE=AC $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen ¹ ACHASOV 10D SND $1.075-2.0 e^+e^- \rightarrow \pi^0\gamma$

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. The width of the highest mass effective resonance is fixed at 315 MeV.

NODE=M126R00
NODE=M126R00

NODE=M126R00;LINKAGE=A

 $\omega(1650)$ REFERENCES

NODE=M126

LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)	REFID=62426
ACHASOV	20A	EPJ C80 993	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60923
ACHASOV	20B	EPJ C80 1008	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60924
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59887
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AKHMETSHIN	17A	PL B773 150	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	REFID=58239
ACHASOV	16B	PR D94 092002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57537
AULCHENKO	15A	JETP 121 27	V.M. Aulchenko <i>et al.</i>	(SND Collab.)	REFID=56843
		Translated from ZETF 148 34.			
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59494
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>		REFID=49177
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>		REFID=48010
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov		REFID=46323
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41867
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40581
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
		Translated from ZETFP 46 132.			
ATKINSON	83B	PL 127B 132	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21502
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)	REFID=21586
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
ESPOSITO	80	LCN 28 195	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)	REFID=21584
COSME	79	NP B152 215	G. Cosme <i>et al.</i>	(IPN)	REFID=21475

$\omega_3(1670)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M045

 $\omega_3(1670)$ MASS

NODE=M045M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1667 ± 4 OUR AVERAGE				
1665.3 ± 5.2 ± 4.5	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1685 ± 20	60	BAUBILLIER	79 HBC	$8.2 K^- p$ backward
1673 ± 12	430	^{1,2} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
1650 ± 12		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
1669 ± 11	600	² WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
1678 ± 14	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
1660 ± 13	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
1679 ± 17	200	MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
1670 ± 20		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 1700	110	¹ CERRADA	77B HBC	$4.2 K^- p \rightarrow \Lambda 3\pi$
1695 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi X$
1636 ± 20		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$

NODE=M045M

OCCUR=2

¹ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.² From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.NODE=M045M;LINKAGE=E
NODE=M045M;LINKAGE=P $\omega_3(1670)$ WIDTH

NODE=M045W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
168 ± 10 OUR AVERAGE				
149 ± 19 ± 7	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
160 ± 80	60	³ BAUBILLIER	79 HBC	$8.2 K^- p$ backward
173 ± 16	430	^{4,5} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
253 ± 39		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
173 ± 28	600	^{3,5} WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
167 ± 40	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
122 ± 39	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
155 ± 40	200	³ MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
90 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi$
100 ± 40		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
112 ± 60		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$

NODE=M045W

OCCUR=2

³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁴ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.⁵ From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.NODE=M045W;LINKAGE=S
NODE=M045W;LINKAGE=E
NODE=M045W;LINKAGE=P $\omega_3(1670)$ DECAY MODES

NODE=M045215;NODE=M045

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \omega\pi\pi$	seen
$\Gamma_3 \quad b_1(1235)\pi$	possibly seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ← $\omega_3(1670)$ BRANCHING RATIOS

NODE=M045220

$\Gamma(\omega\pi\pi)/\Gamma(\rho\pi)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.71 ± 0.27	100	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	
$\Gamma(b_1(1235)\pi)/\Gamma(\rho\pi)$					Γ_3/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	
possibly seen		DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	

NODE=M045R3
NODE=M045R3NODE=M045R4
NODE=M045R4

$\Gamma(b_1(1235)\pi)/\Gamma(\omega\pi\pi)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

>0.75	68	BAUBILLIER	79	HBC	8.2 $K^- p$ backward
-------	----	------------	----	-----	----------------------

NODE=M045R5
NODE=M045R5

 $\omega_3(1670)$ REFERENCES

AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BAUBILLIER	79	PL 89B 131	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BALTAY	78E	PRL 40 87	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
CORDEN	78B	NP B138 235	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+) JP
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)
MATTHEWS	71D	PR D3 2561	J.A.J. Matthews <i>et al.</i>	(TNTO, WISC)
BARNES	69B	PRL 23 142	V.E. Barnes <i>et al.</i>	(BNL)
KENYON	69	PRL 23 146	I.R. Kenyon <i>et al.</i>	(BNL, UCND, ORNL)
ARMENISE	68B	PL 26B 336	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)

NODE=M045

REFID=44649
REFID=21522
REFID=21520
REFID=21269
REFID=20537
REFID=20843
REFID=21248
REFID=21515
REFID=21512
REFID=20800
REFID=20783

NODE=M034

 $\pi_2(1670)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

 $\pi_2(1670)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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1670.6^{+2.9}_{-1.2} OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

1642	$^{+12}_{-1}$	46M	1	AGHASYAN	18B	COMP	190	$\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$		
1749	± 10	± 100	145k	LU	05	B852	18	$\pi^- p \rightarrow \omega \pi^- \pi^0 p$		
1676	± 3	± 8		2	CHUNG	02	B852	18.3	$\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
1685	± 10	± 30		BARBERIS	01		450	$pp \rightarrow p_f 3\pi^0 p_s$		
1687	± 9	± 15		AMELIN	99	VES	37	$\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$		
1669	± 4			BARBERIS	98B		450	$pp \rightarrow p_f \rho \pi p_s$		
1670	± 4			BARBERIS	98B		450	$pp \rightarrow p_f f_2(1270) \pi p_s$		
1690	± 14			3	BERDNIKOV	94	VES	37	$\pi^- A \rightarrow K^+ K^- \pi^- A$	
1710	± 20	700		ANTIPOV	87	SIGM	-	50	$\pi^- \text{Cu} \rightarrow \mu^+ \mu^- \pi^- \text{Cu}$	
1676	± 6			3	EVANGELIS...	81	OMEG	-	12	$\pi^- p \rightarrow 3\pi p$
1657	± 14			3,4	DAUM	80D	SPEC	-	63-94	$\pi p \rightarrow 3\pi X$
1662	± 10	2000		3	BALTAY	77	HBC	+	15	$\pi^+ p \rightarrow p 3\pi$

NODE=M034M

NODE=M034M

OCCUR=2

••• We do not use the following data for averages, fits, limits, etc. •••

1658	± 3	$^{+24}_{-8}$	420k	5	ALEKSEEV	10	COMP	190	$\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$	
1730	± 20			6	AMELIN	95B	VES	36	$\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$	
1742	± 31	± 49			ANTREASYAN	90	CBAL		$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$	
1624	± 21			2	BELLINI	85	SPEC	40	$\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$	
1622	± 35			7	BELLINI	85	SPEC	40	$\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$	
1693	± 28			8	BELLINI	85	SPEC	40	$\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$	
1710	± 20			9	DAUM	81B	SPEC	-	63,94	$\pi^- p$
1660	± 10			3	ASCOLI	73	HBC	-	5-25	$\pi^- p \rightarrow p \pi_2$

OCCUR=2

OCCUR=3

¹ Statistical error negligible.

² From $f_2(1270)\pi$ decay.

³ From a fit to $J^P = 2^- S$ -wave $f_2(1270)\pi$ partial wave.

⁴ Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.

⁵ Superseded by AGHASYAN 2018B.

⁶ J^{PC} ambiguous.

⁷ From $\rho\pi$ decay.

⁸ From $\sigma\pi$ decay.

NODE=M034M;LINKAGE=A

NODE=M034M;LINKAGE=F2

NODE=M034M;LINKAGE=P

NODE=M034M;LINKAGE=D

NODE=M034M;LINKAGE=B

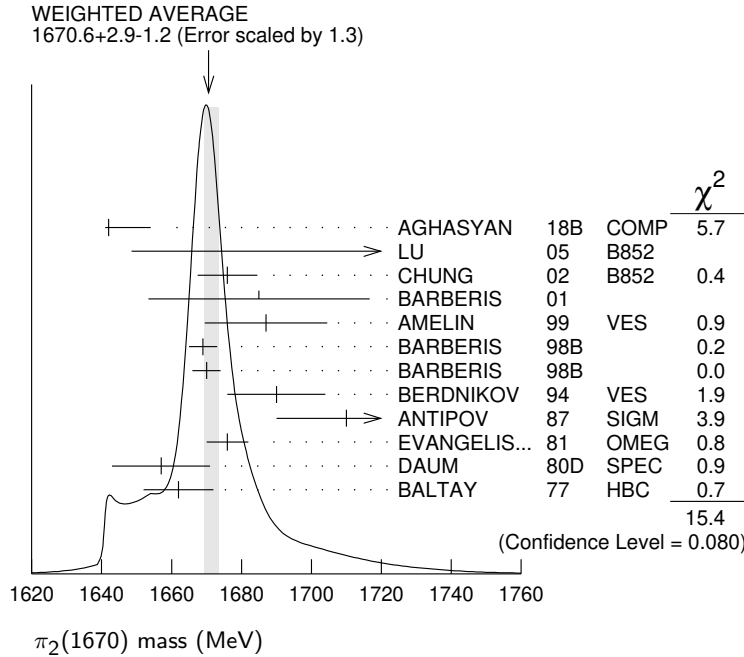
NODE=M034M;LINKAGE=AX

NODE=M034M;LINKAGE=R2

NODE=M034M;LINKAGE=S2

⁹ From a two-resonance fit to four 2^-0^+ waves. This should not be averaged with all the single resonance fits.

NODE=M034M;LINKAGE=L



$\pi_2(1670)$ WIDTH

NODE=M034W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
258⁺⁸₋₉	OUR AVERAGE	Error includes scale factor of 1.2.			
311 ⁺¹² ₋₂₃	46M	¹⁰ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
408 \pm 60 \pm 250	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
254 \pm 3 \pm 31		¹¹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
265 \pm 30 \pm 40		BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
168 \pm 43 \pm 53		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268 \pm 15		BARBERIS	98B		450 $pp \rightarrow p_f p \pi p_s$
256 \pm 15		BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
190 \pm 50		¹² BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170 \pm 80	700	ANTIPOV	87	SIGM	- 50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
260 \pm 20		¹² EVANGELIS...	81	OMEG	- 12 $\pi^- p \rightarrow 3\pi p$
219 \pm 20		^{12,13} DAUM	80D	SPEC	- 63-94 $\pi p \rightarrow 3\pi X$
285 \pm 60	2000	¹² BALTAY	77	HBC	+ 15 $\pi^+ p \rightarrow p 3\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
271 \pm 9 ⁺²² ₋₂₄	420k	¹⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
310 \pm 20		¹⁵ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
236 \pm 49 \pm 36		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
304 \pm 22		¹¹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
404 \pm 108		¹⁶ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
330 \pm 90		¹⁷ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
312 \pm 50		¹⁸ DAUM	81B	SPEC	- 63,94 $\pi^- p$
270 \pm 60		¹² ASCOLI	73	HBC	- 5-25 $\pi^- p \rightarrow p \pi_2$

NODE=M034W

NODE=M034W

OCCUR=2

OCCUR=2

OCCUR=3

- ¹⁰ Statistical error negligible.
¹¹ From $f_2(1270)\pi$ decay.
¹² From a fit to $J^P = 2^- f_2(1270)\pi$ partial wave.
¹³ Clear phase rotation seen in $2^- S, 2^- P, 2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.
¹⁴ Superseded by AGHASYAN 2018B.
¹⁵ J^{PC} ambiguous.
¹⁶ From $\rho\pi$ decay.
¹⁷ From $\sigma\pi$ decay.
¹⁸ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034W;LINKAGE=A
 NODE=M034W;LINKAGE=F2
 NODE=M034W;LINKAGE=P
 NODE=M034W;LINKAGE=D

 NODE=M034W;LINKAGE=B
 NODE=M034W;LINKAGE=AX
 NODE=M034W;LINKAGE=R2
 NODE=M034W;LINKAGE=S2
 NODE=M034W;LINKAGE=L

$\pi_2(1670)$ DECAY MODES

NODE=M034215;NODE=M034

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 3π	$(95.8 \pm 1.4) \%$		DESIG=20
Γ_2 $\pi^+ \pi^- \pi^0$			DESIG=22
Γ_3 $\pi^0 \pi^0 \pi^0$			DESIG=23
Γ_4 $f_2(1270)\pi$	$(56.3 \pm 3.2) \%$		DESIG=8
Γ_5 $\rho\pi$	$(31 \pm 4) \%$		DESIG=2
Γ_6 $\sigma\pi$	$(10 \pm 4) \%$		DESIG=13
Γ_7 $\pi(\pi\pi)_S$ -wave	$(8.7 \pm 3.4) \%$		DESIG=11
Γ_8 $\pi^\pm \pi^+ \pi^-$	$(53 \pm 4) \%$		DESIG=10
Γ_9 $K \bar{K}^*(892) + c.c.$	$(4.2 \pm 1.4) \%$		DESIG=5
Γ_{10} $\omega\rho$	$(2.7 \pm 1.1) \%$		DESIG=14
Γ_{11} $\pi^\pm \gamma$	$(7.0 \pm 1.2) \times 10^{-4}$		DESIG=27
Γ_{12} $\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%	DESIG=12
Γ_{13} $\eta\pi$	$< 5 \%$		DESIG=3
Γ_{14} $\pi^\pm 2\pi^+ 2\pi^-$	$< 5 \%$		DESIG=4
Γ_{15} $\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%	DESIG=15
Γ_{16} $b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%	DESIG=16
Γ_{17} $f_1(1285)\pi$	possibly seen		DESIG=25
Γ_{18} $a_2(1320)\pi$	not seen		DESIG=26

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 1.9$ for 3 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	-53		
x_7	-29	-59	
x_9	-8	-21	-9
	x_4	x_5	x_7

$\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

$\Gamma(\pi^\pm \gamma)$						Γ_{11}
VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT		
$181 \pm 11 \pm 27$	19 ADOLPH	14	COMP	-	190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$	

NODE=M034W2
 NODE=M034W2

- ¹⁹ Primakoff reaction. Assumes incoherent $f_2(1270)\pi$ contribution to 3π final state and uses $B(\pi_2(1670) \rightarrow f_2\pi) = 56\%$.

NODE=M034W2;LINKAGE=AD

$\Gamma(\gamma\gamma)$ Γ_{12}

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.072	90	20 ACCIARRI	97T L3		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
<0.19	90	20 ALBRECHT	97B ARG		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.41 ±0.23±0.28		ANTREASYAN 90	CBAL 0		$e^+e^- \rightarrow e^+e^-\pi^0\pi^0\pi^0$
0.8 ±0.3 ±0.12		21 BEHREND	90C CELL 0		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.3 ±0.3 ±0.2		22 BEHREND	90C CELL 0		$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

NODE=M034W1
 NODE=M034W1

• • • We do not use the following data for averages, fits, limits, etc. • • •

²⁰ Decaying into $f_2(1270)\pi$ and $\rho\pi$.

²¹ Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

²² Incoherent Ansatz.

OCCUR=2

NODE=M034W1;LINKAGE=QQ

NODE=M034W1;LINKAGE=C

NODE=M034W1;LINKAGE=G

 $\pi_2(1670) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M034230

 $\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{12}/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	²³ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

NODE=M034G01
 NODE=M034G01

²³ From analysis of L3 data at 183–209 GeV.

NODE=M034G01;LINKAGE=SC

 $\pi_2(1670) \text{ BRANCHING RATIOS}$

NODE=M034220

 $\Gamma(3\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7)/\Gamma$

VALUE	DOCUMENT ID
0.958 ± 0.014 OUR FIT	

NODE=M034R20
 NODE=M034R20

 $\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_3/Γ_2

VALUE	DOCUMENT ID	COMMENT
0.29 ± 0.03 ± 0.05	BARBERIS 01	450 $\rho\rho \rightarrow \rho_f 3\pi^0 \rho_s$

NODE=M034R21
 NODE=M034R21

 $\Gamma(\rho\pi)/0.565\Gamma(f_2(1270)\pi)$ $\Gamma_5/0.565\Gamma_4$ (With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.09 OUR AVERAGE	Error includes scale factor of 1.9.		
0.76 ± 0.07 ± 0.10	CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$
1.01 ± 0.05	BARBERIS 98B		450 $\rho\rho \rightarrow \rho_f \pi^+\pi^-\pi^0 \rho_s$

NODE=M034R16
 NODE=M034R16
 NODE=M034R16

 $\Gamma(\sigma\pi)/\Gamma(f_2(1270)\pi)$ Γ_6/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 ± 0.02 ± 0.07	CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

NODE=M034R15
 NODE=M034R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.24 ± 0.10 ^{24,25} BAKER 99 SPEC 1.94 $\bar{p}p \rightarrow 4\pi^0$

 $\frac{1}{2}\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\frac{1}{2}\Gamma_5/\Gamma_8 = \frac{1}{2}\Gamma_5/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.29 ± 0.04 OUR FIT				
0.29 ± 0.05	²⁶ DAUM	81B	SPEC	63.94 $\pi^- p$

NODE=M034R2
 NODE=M034R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.3 BARTSCH 68 HBC + 8 $\pi^+ p \rightarrow 3\pi p$

 $0.565\Gamma(f_2(1270)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.565\Gamma_4/\Gamma_8 = 0.565\Gamma_4/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$ (With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.604 ± 0.035 OUR FIT				
0.60 ± 0.05 OUR AVERAGE	Error includes scale factor of 1.3.			

NODE=M034R3

NODE=M034R3

NODE=M034R3

0.61 ± 0.04 ²⁶ DAUM 81B SPEC 63.94 $\pi^- p$

0.76 $\begin{matrix} +0.24 \\ -0.34 \end{matrix}$ ARMENISE 69 DBC + 5.1 $\pi^+ d \rightarrow d3\pi$

0.35 ± 0.20 BALTAY 68 HBC + 7–8.5 $\pi^+ p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.59 BARTSCH 68 HBC + 8 $\pi^+ p \rightarrow 3\pi p$

$0.624\Gamma(\pi(\pi\pi)_{S\text{-wave}})/\Gamma(\pi^\pm\pi^+\pi^-)$

$0.624\Gamma_7/\Gamma_8 = 0.624\Gamma_7/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

(With $(\pi\pi)_{S\text{-wave}} \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.10±0.04 OUR FIT			
0.10±0.05	26 DAUM	81B SPEC	63,94 $\pi^- p$

NODE=M034R11

NODE=M034R11

NODE=M034R11

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(f_2(1270)\pi)$ **Γ_9/Γ_4**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.075±0.025 OUR FIT				
0.075±0.025	27 ARMSTRONG	82B OMEG	-	16 $\pi^- p \rightarrow K^+ K^- \pi^- p$

NODE=M034R13

NODE=M034R13

 $\Gamma(\omega\rho)/\Gamma_{\text{total}}$ **Γ_{10}/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
0.027±0.004±0.010	28 AMELIN	99 VES	37 $\pi^- A \rightarrow \omega\pi^- \pi^0 A^*$

NODE=M034R17

NODE=M034R17

 $\Gamma(\eta\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$

$\Gamma_{13}/\Gamma_8 = \Gamma_{13}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

(All η decays.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.09	BALTAY	68 HBC	+	7-8.5 $\pi^+ p$
••• We do not use the following data for averages, fits, limits, etc. •••				
<0.10	CRENNELL	70 HBC	-	6 $\pi^- p \rightarrow f_2\pi^- N$

NODE=M034R5

NODE=M034R5

NODE=M034R5

 $\Gamma(\pi^\pm 2\pi^+ 2\pi^-)/\Gamma(\pi^\pm\pi^+\pi^-)$

$\Gamma_{14}/\Gamma_8 = \Gamma_{14}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	CRENNELL	70 HBC	-	6 $\pi^- p \rightarrow f_2\pi^- N$
••• We do not use the following data for averages, fits, limits, etc. •••				
<0.1	BALTAY	68 HBC	+	7,8.5 $\pi^+ p$

NODE=M034R6

NODE=M034R6

 $\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$ **Γ_{15}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN	99 VES	37 $\pi^- A \rightarrow \omega\pi^- \pi^0 A^*$

NODE=M034R18

NODE=M034R18

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ **Γ_{16}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN	99 VES	37 $\pi^- A \rightarrow \omega\pi^- \pi^0 A^*$

NODE=M034R19

NODE=M034R19

 $\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$ **Γ_{17}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	69k	KUHN	04 B852	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

NODE=M034R23

NODE=M034R23

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ **Γ_{18}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	69k	KUHN	04 B852	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

NODE=M034R24

NODE=M034R24

D-wave/S-wave RATIO FOR $\pi_2(1670) \rightarrow f_2(1270)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.18±0.06	24 BAKER	99 SPEC	1.94 $\bar{p}p \rightarrow 4\pi^0$
••• We do not use the following data for averages, fits, limits, etc. •••			
0.22±0.10	26 DAUM	81B SPEC	63,94 $\pi^- p$

NODE=M034R14

NODE=M034R14

F-wave/P-wave RATIO FOR $\pi_2(1670) \rightarrow \rho\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.72±0.07±0.14	CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

NODE=M034R22

NODE=M034R22

24 Using preliminary CBAR data.

25 With the $\sigma\pi$ in $L=2$ and the $f_2(1270)\pi$ in $L=0$.26 From a two-resonance fit to four 2^-0^+ waves.27 From a partial-wave analysis of $K^+K^-\pi^-$ system.28 Normalized to the $B(\pi_2(1670) \rightarrow f_2\pi)$.

NODE=M034R;LINKAGE=BK

NODE=M034R15;LINKAGE=A

NODE=M034R;LINKAGE=L

NODE=M034R13;LINKAGE=M

NODE=M034R;LINKAGE=DM

$\pi_2(1670)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
ANTREASYAN	90	ZPHY C48 561	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ANTIPOV	87	EPL 4 403	Y.M. Antipov <i>et al.</i>	(SERP, JINR, INRM+)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
		Translated from YAF 41 1223.		
ARMSTRONG	82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
		Also NP B186 594	C. Evangelista	
DAUM	80D	PL 89B 285	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
ASCOLI	73	PR D7 669	G. Ascoli	(ILL, TINTO, GENO, HAMB, MILA+) JP
CRENNELL	70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE	69	LCN 2 501	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
BARTSCH	68	NP B7 345	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN) JP

NODE=M034

REFID=59471
 REFID=55911
 REFID=53356
 REFID=51186
 REFID=50459
 REFID=49773
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 REFID=48324
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 REFID=44073
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 REFID=20872
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 REFID=20847
 REFID=21553
 REFID=20805
 REFID=20689
 REFID=21531
 REFID=21532

NODE=M067

$\phi(1680)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

$\phi(1680)$ MASS

NODE=M067205

e^+e^- PRODUCTION

NODE=M067M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1680 ± 20				OUR ESTIMATE
• • •				We do not use the following data for averages, fits, limits, etc. • • •
1663 ± 5	$^{+16}_{-4}$	ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
1656.8 ± 4.9		¹ LICHARD	23 RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$
1683 ± 7 ± 9		² ZHU	23 BELL	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$
1678 $^{+5}_{-3}$ ± 7		³ ZHU	23A RVUE	$e^+e^- \rightarrow \eta \phi$
1673 ± 5		⁴ ABLIKIM	22L BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$
1680 $^{+12}_{-13}$ ± 21	1.8k	⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+K^-\eta$
1662 ± 20		⁶ ACHASOV	20C SND	$1.3-2.0 e^+e^- \rightarrow K^+K^-\pi^0$
1641 $^{+24}_{-18}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
1667 ± 5 ± 11	3k	⁷ IVANOV	19A CMD3	$1.59-2.007 e^+e^- \rightarrow K^+K^-\eta$
1700 ± 23	2k	⁸ ACHASOV	18A SND	$1.3-2.0 e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
1674 ± 12 ± 6	6.2k	⁹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
1733 ± 10 ± 10		¹⁰ LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi \pi^+\pi^-\gamma$
1689 ± 7 ± 10	4.8k	¹¹ SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1709 ± 20 ± 43		¹² AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \text{hadrons}$
1623 ± 20	948	¹³ AKHMETSHIN	03 CMD2	$1.05-1.38 e^+e^- \rightarrow K_L^0 K_S^0$
~ 1500		¹⁴ ACHASOV	98H RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, \omega \pi^+\pi^-, K^+K^-$
~ 1900		¹⁵ ACHASOV	98H RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700 ± 20		¹⁶ CLEGG	94 RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K \pi$
1657 ± 27	367	BISELLO	91C DM2	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1655 ± 17		¹⁷ BISELLO	88B DM2	$e^+e^- \rightarrow K^+K^-$
1680 ± 10		¹⁸ BUON	82 DM1	$e^+e^- \rightarrow \text{hadrons}$
1677 ± 12		¹⁹ MANE	82 DM1	$e^+e^- \rightarrow K_S^0 K \pi$

NODE=M067M1

NODE=M067M1

→ UNCHECKED ←

OCCUR=4

- ¹ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7σ statistical evidence. NODE=M067M1;LINKAGE=I
- ² From a fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution. NODE=M067M1;LINKAGE=H
- ³ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. NODE=M067M1;LINKAGE=J
- ⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only. NODE=M067M1;LINKAGE=G
- ⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+K^-\eta = (12.0 \pm 1.3_{-6.9}^{+6.5}) \times 10^{-6}$. NODE=M067M1;LINKAGE=E
- ⁶ From a fit using a vector meson dominance model with contribution from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, $\rho(1450)$. NODE=M067M1;LINKAGE=F
- ⁷ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution. NODE=M067M1;LINKAGE=D
- ⁸ Assuming the $K\bar{K}^*(892) + c.c.$ dynamics. Systematic uncertainties not estimated. NODE=M067M1;LINKAGE=C
- ⁹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$. NODE=M067M1;LINKAGE=B
- ¹⁰ Using events with $\pi\pi$ invariant mass less than 0.85 GeV. NODE=M067M1;LINKAGE=A
- ¹¹ From a fit with two incoherent Breit-Wigners. NODE=M067M1;LINKAGE=SH
- ¹² From the simultaneous fit to the $K\bar{K}^*(892) + c.c.$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK. NODE=M067M1;LINKAGE=AU
- ¹³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. NODE=M067M;LINKAGE=HK
- ¹⁴ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and AN-TONELLI 92. NODE=M067M1;LINKAGE=L1
- ¹⁵ Using the data from BISELLO 91C. NODE=M067M1;LINKAGE=L4
- ¹⁶ Using BISELLO 88B and MANE 82 data. NODE=M067M;LINKAGE=A
- ¹⁷ From global fit including ρ , ω , ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation. NODE=M067M;LINKAGE=E
- ¹⁸ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0K_L^0$, $K_S^0K_L^\pm\pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation. NODE=M067M;LINKAGE=C
- ¹⁹ Fit to one channel only, neglecting interference with ω , $\rho(1700)$. NODE=M067M;LINKAGE=D

 $\rho\bar{\rho}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1700 ± 8	¹ AMSLER 06	CBAR	$0.9 \bar{p}p \rightarrow K^+K^-\pi^0$

¹ Could also be $\rho(1700)$.

NODE=M067M3
NODE=M067M3

NODE=M067M3;LINKAGE=AM

 $\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
150 ± 50	OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.		

NODE=M067W1
NODE=M067W1

→ UNCHECKED ←

••• We do not use the following data for averages, fits, limits, etc. •••

159 $\pm 15 \pm 11$	ABLIKIM	24CB	BES3	$J/\psi \rightarrow \phi\eta\pi^0$
150.8 ± 7.0	¹ LICHARD	23	RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
149 $\pm 12 \pm 13$	² ZHU	23	BELL	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
156 $\pm 5 \pm 9$	³ ZHU	23A	RVUE	$e^+e^- \rightarrow \eta\phi$
172 ± 8	⁴ ABLIKIM	22L	BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$
185 $\begin{smallmatrix} +30 \\ -26 \end{smallmatrix} \begin{smallmatrix} +25 \\ -47 \end{smallmatrix}$ 1.8k	⁵ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+K^-\eta$
159 ± 32	⁶ ACHASOV	20C	SND	$1.3-2.0 e^+e^- \rightarrow K^+K^-\pi^0$
103 $\begin{smallmatrix} +26 \\ -24 \end{smallmatrix}$	ACHASOV	19	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
176 $\pm 23 \pm 38$ 3k	⁷ IVANOV	19A	CMD3	$1.59-2.007 e^+e^- \rightarrow K^+K^-\eta$
300 ± 50 2k	⁸ ACHASOV	18A	SND	$1.3-2.0 e^+e^- \rightarrow K_S^0K_L^0\pi^0$
165 $\pm 38 \pm 70$ 6.2k	⁹ LEES	14H	BABR	$e^+e^- \rightarrow K_S^0K_L^0\gamma$
300 $\pm 15 \pm 37$	¹⁰ LEES	12F	BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$

211	$\pm 14 \pm 19$	4.8k	11 SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
322	$\pm 77 \pm 160$		12 AUBERT	08s BABR	$10.6 e^+ e^- \rightarrow \text{hadrons}$
139	± 60	948	13 AKHMETSHIN	03 CMD2	$1.05\text{--}1.38 e^+ e^- \rightarrow K_L^0 K_S^0$
300	± 60		14 CLEGG	94 RVUE	$e^+ e^- \rightarrow K^+ K^-, K_S^0 K \pi$
146	± 55	367	BISELLO	91c DM2	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
207	± 45		15 BISELLO	88B DM2	$e^+ e^- \rightarrow K^+ K^-$
185	± 22		16 BUON	82 DM1	$e^+ e^- \rightarrow \text{hadrons}$
102	± 36		17 MANE	82 DM1	$e^+ e^- \rightarrow K_S^0 K \pi$

¹ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7σ statistical evidence.

² From a fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution.

³ From the analysis of the combined measurements of $\sigma(e^+ e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3.

⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (12.0 \pm 1.3^{+6.5}_{-6.9}) \times 10^{-6}$.

⁶ From a fit using a vector meson dominance model with contribution from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, $\rho(1450)$.

⁷ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

⁸ Assuming the $K\bar{K}^*(892) + \text{c.c.}$ dynamics. Systematic uncertainties not estimated.

⁹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

¹⁰ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

¹¹ From a fit with two incoherent Breit-Wigners.

¹² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

¹³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.

¹⁴ Using BISELLO 88B and MANE 82 data.

¹⁵ From global fit including ρ , ω , ϕ and $\rho(1700)$

¹⁶ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0 K_L^0$, $K_S^0 K^\pm \pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.

¹⁷ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=I

NODE=M067W1;LINKAGE=H

NODE=M067W1;LINKAGE=J

NODE=M067W1;LINKAGE=G

NODE=M067W1;LINKAGE=E

NODE=M067W1;LINKAGE=F

NODE=M067W1;LINKAGE=D

NODE=M067W1;LINKAGE=C

NODE=M067W1;LINKAGE=B

NODE=M067W1;LINKAGE=A

NODE=M067W1;LINKAGE=SH

NODE=M067W1;LINKAGE=AU

NODE=M067W;LINKAGE=HK

NODE=M067W;LINKAGE=A

NODE=M067W;LINKAGE=E

NODE=M067W;LINKAGE=C

NODE=M067W;LINKAGE=D

NODE=M067W3

NODE=M067W3

$\rho\bar{\rho}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

143 \pm 24	¹ AMSLER	06	CBAR	$0.9 \bar{p}p \rightarrow K^+ K^- \pi^0$
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¹ Could also be $\rho(1700)$.

NODE=M067W3;LINKAGE=AM

$\phi(1680)$ DECAY MODES

NODE=M067215;NODE=M067

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	seen
Γ_2 $K_S^0 K \pi$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $K_L^0 K_S^0$	
Γ_5 $e^+ e^-$	seen
Γ_6 $\omega\pi\pi$	not seen
Γ_7 $\phi\pi\pi$	
Γ_8 $K^+ K^- \pi^+ \pi^-$	seen
Γ_9 $\eta\phi$	seen
Γ_{10} $\eta\gamma$	seen
Γ_{11} $K^+ K^- \pi^0$	
Γ_{12} $f_2'(1525)\gamma$	not seen

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=11

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=10

DESIG=13

DESIG=2

DESIG=15

$\phi(1680) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel (I) in e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(I)$ or the branching ratio $\Gamma(I)/\text{total}$.

NODE=M067220

NODE=M067220

 $\Gamma(K_L^0 K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4 \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

14.3±2.4±6.2	6.2k	¹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
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¹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

NODE=M067A00
NODE=M067A00

NODE=M067A00;LINKAGE=A

 $\Gamma(\phi\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7 \Gamma_5 / \Gamma$

VALUE (10 ⁻² keV)	DOCUMENT ID	TECN	COMMENT
------------------------------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2±0.2±0.3	LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
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NODE=M067G02
NODE=M067G02 $\Gamma(\eta\phi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9 \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

122± 6±13		¹ ZHU	23 BELL	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
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65 ⁺ ₄ ±13 to		² ZHU	23A RVUE	$e^+e^- \rightarrow \eta\phi$
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215 ⁺ ₅ ±11				
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94±13±15	3k	³ IVANOV	19A CMD3	$1.59-2.007 e^+e^- \rightarrow K^+K^-\eta$
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¹ From a solution of the fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution. Other solutions with equal fit quality give (219 ± 15 ± 18) eV, (163 ± 11 ± 13) eV and (203 ± 12 ± 18) eV.

² From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. Four solutions are found, with equal fit quality: (79 ± 4 ± 16) eV, (127 ± 5 ± 12) eV, (65⁺₄ ± 13) eV, (215⁺₅ ± 11) eV.

³ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

NODE=M067R00
NODE=M067R00

NODE=M067R00;LINKAGE=B

NODE=M067R00;LINKAGE=C

NODE=M067R00;LINKAGE=A

 $\phi(1680) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

This combination of a branching ratio into channel (i) and branching ratio into e^+e^- is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (i) or e^+e^- .

NODE=M067223

NODE=M067223

 $\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.131±0.059	948	¹ AKHMETSHIN 03	CMD2	$1.05-1.38 e^+e^- \rightarrow K_L^0 K_S^0$
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¹ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. Recalculated by us.

NODE=M067G5
NODE=M067G5

NODE=M067G;LINKAGE=GK

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.15±0.16±0.01		¹ AUBERT	08S BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma + \text{c.c.}$
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3.29±1.57	367	² BISELLO	91C DM2	$1.35-2.40 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
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¹ From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

² Recalculated by us with the published value of $B(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)$.

NODE=M067G6
NODE=M067G6

NODE=M067G6;LINKAGE=AU

NODE=M067G;LINKAGE=GL

 $\Gamma(\phi\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10 ⁻⁷)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.86±0.14±0.21	4.8k	¹ SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
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¹ Multiplied by 3/2 to take into account the $\phi\pi^0\pi^0$ mode. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.

NODE=M067G01
NODE=M067G01

NODE=M067G01;LINKAGE=SH

$\Gamma(\eta\phi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.64^{+1.74}_{-1.80}$		ACHASOV	19	SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
$5.3 \pm 0.6 \pm 0.9$	3k	¹ IVANOV	19A	CMD3 $e^+e^- \rightarrow K^+K^-\eta$
$4.3 \pm 1.0 \pm 0.9$		² AUBERT	08S	BABR $10.6 e^+e^- \rightarrow \phi\eta\gamma$

¹ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

NODE=M067G7
NODE=M067G7

NODE=M067G7;LINKAGE=A
NODE=M067G7;LINKAGE=AU

 $\phi(1680)$ BRANCHING RATIOS $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K_S^0 K\pi) \quad \Gamma_1/\Gamma_2$

VALUE	DOCUMENT ID	TECN	COMMENT
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dominant	MANE	82	DM1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
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NODE=M067225

NODE=M067R3
NODE=M067R3

 $\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_3/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.07 ± 0.01	BUON	82	DM1 e^+e^-
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NODE=M067R2
NODE=M067R2

 $\Gamma(\omega\pi\pi)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_6/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
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< 0.10	BUON	82	DM1 e^+e^-
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NODE=M067R1
NODE=M067R1

 $\Gamma(\eta\phi)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

seen	35	¹ ACHASOV	14	SND $1.15-2.00 e^+e^- \rightarrow \eta\gamma$
------	----	----------------------	----	---

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R01
NODE=M067R01

NODE=M067R01;LINKAGE=A

 $\Gamma(\eta\phi)/\Gamma(K\bar{K}^*(892) + \text{c.c.}) \quad \Gamma_9/\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

≈ 0.37	¹ AUBERT	08S	BABR $10.6 e^+e^- \rightarrow \text{hadrons}$
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¹ From the fit including data from AUBERT 07AK.

NODE=M067R5
NODE=M067R5

NODE=M067R5;LINKAGE=AU

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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seen	35	¹ ACHASOV	14	SND $1.15-2.00 e^+e^- \rightarrow \eta\gamma$
------	----	----------------------	----	---

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R02
NODE=M067R02

NODE=M067R02;LINKAGE=A

 $\Gamma(f_2'(1525)\gamma)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	¹ ACHASOV	22	SND $1.17-2.00 e^+e^- \rightarrow \eta\eta\gamma$
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¹ The 90% CL upper limit on the Born cross sections $\sigma(e^+e^- \rightarrow \phi(1680) \rightarrow f_2'(1525)\gamma \rightarrow \eta\eta\gamma)$ and $\sigma(e^+e^- \rightarrow \rho(1700) \rightarrow f_0(1500)\gamma \rightarrow \eta\eta\gamma)$ is 10.6 pb.

NODE=M067R03
NODE=M067R03

NODE=M067R03;LINKAGE=A

 $\phi(1680)$ REFERENCES

ABLIKIM	24CB	PR D110 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63033
LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)	REFID=62426
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)	REFID=61911
ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)	REFID=62439
ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61649
ACHASOV	22	EPJ C82 168	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61655
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
ACHASOV	20C	EPJ C80 1139	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60935
ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59887
IVANOV	19A	PL B798 134946	V.L. Ivanov <i>et al.</i>	(CMD-3 Collab.)	REFID=60133
ACHASOV	18A	PR D97 032011	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=58883
ACHASOV	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55912
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000

NODE=M067

AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49172
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin		REFID=48827
		Translated from YAF 65 1255.			
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov		REFID=46323
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41867
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40581
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
		Translated from ZETFP 46 132.			
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)	REFID=21494
MANE	82	PL 112B 178	F. Mane <i>et al.</i>	(LALO)	REFID=21590
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
MANE	81	PL 99B 261	F. Mane <i>et al.</i>	(ORSAY)	REFID=21588

NODE=M015

 $\rho_3(1690)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

 $\rho_3(1690)$ MASS

NODE=M015205

VALUE (MeV) _____ DOCUMENT ID _____
1688.8±2.1 OUR AVERAGE Includes data from the 5 datablocks that follow this one.

NODE=M015M

2 π MODE

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
 The data in this block is included in the average printed for a previous datablock.

NODE=M015M1
NODE=M015M1**1686± 4 OUR AVERAGE**

1677±14		EVANGELIS...	81	OMEG	-	12 $\pi^- p \rightarrow 2\pi p$
1679±11	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow \pi^+ \pi^- n$
1678±12	175	¹ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p3\pi$
1690± 7	600	¹ ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow \pi^+ \pi^- p$
1693± 8		² GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
1678±12		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
1734±10		³ CORDEN	79	OMEG		12-15 $\pi^- p \rightarrow n2\pi$
1692±12		^{2,4} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$
1737±23		ARMENISE	70	DBC	0	9 $\pi^+ N$
1650±35	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N2\pi$
1687±21		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
1683±13		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
1670±30		GOLDBERG	65	HBC	0	6 $\pi^+ d, 8 \pi^- p$

¹ Mass errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass.² Uses same data as HYAMS 75.³ From a phase shift solution containing a $f_2'(1525)$ width two times larger than the $K\bar{K}$ result.⁴ From phase-shift analysis. Error takes account of spread of different phase-shift solutions.NODE=M015M1;LINKAGE=E
NODE=M015M1;LINKAGE=G
NODE=M015M1;LINKAGE=M

NODE=M015M1;LINKAGE=I

 $K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
 The data in this block is included in the average printed for a previous datablock.

NODE=M015M2
NODE=M015M2**1696± 4 OUR AVERAGE**

1699± 5		ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$
1698±12	6k	^{5,6} MARTIN	78D	SPEC		10 $\pi p \rightarrow K_S^0 K^- p$
1692± 6		BLUM	75	ASPK	0	18.4 $\pi^- p \rightarrow nK^+ K^-$
1690±16		ADERHOLZ	69	HBC	+	8 $\pi^+ p \rightarrow K\bar{K}\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
1694± 8		⁷ COSTA	80	OMEG		10 $\pi^- p \rightarrow K^+ K^- n$

⁵ From a fit to $J^P = 3^-$ partial wave.⁶ Systematic error on mass scale subtracted.⁷ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.NODE=M015M2;LINKAGE=P
NODE=M015M2;LINKAGE=S
NODE=M015M2;LINKAGE=L

(4 π) \pm MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M015M3
 NODE=M015M3

1686 \pm 5 OUR AVERAGE Error includes scale factor of 1.1.

1694 \pm 6		⁸ EVANGELIS...	81	OMEG	-	12 $\pi^- p \rightarrow \rho 4\pi$
1665 \pm 15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow \rho 4\pi$
1670 \pm 10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687 \pm 20		CASON	73	HBC	-	8,18.5 $\pi^- p$
1685 \pm 14		⁹ CASON	73	HBC	-	8,18.5 $\pi^- p$
1680 \pm 40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 4\pi$
1689 \pm 20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\rho$
1705 \pm 21		CASO	70	HBC	-	11.2 $\pi^- p \rightarrow n \rho 2\pi$
1718 \pm 10		¹⁰ EVANGELIS...	81	OMEG	-	12 $\pi^- p \rightarrow \rho 4\pi$
1673 \pm 9		¹¹ EVANGELIS...	81	OMEG	-	12 $\pi^- p \rightarrow \rho 4\pi$
1733 \pm 9	66	⁹ KLIGER	74	HBC	-	4.5 $\pi^- p \rightarrow \rho 4\pi$
1630 \pm 15		HOLMES	72	HBC	+	10-12 $K^+ p$
1720 \pm 15		BALTAY	68	HBC	+	7, 8.5 $\pi^+ p$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

⁸ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.⁹ From $\rho^\pm \rho^0$ mode.¹⁰ From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.¹¹ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

NODE=M015M3;LINKAGE=A

NODE=M015M3;LINKAGE=F

NODE=M015M3;LINKAGE=B

NODE=M015M3;LINKAGE=C

 $\omega\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M015M5
 NODE=M015M5

1681 \pm 7 OUR AVERAGE

1670 \pm 25		¹² ALDE	95	GAM2		38 $\pi^- p \rightarrow \omega \pi^0 n$
1690 \pm 15		EVANGELIS...	81	OMEG	-	12 $\pi^- p \rightarrow \omega \pi p$
1666 \pm 14		GESSAROLI	77	HBC		11 $\pi^- p \rightarrow \omega \pi p$
1686 \pm 9		THOMPSON	74	HBC	+	13 $\pi^+ p$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1654 \pm 24 BARNHAM 70 HBC + 10 $K^+ p \rightarrow \omega \pi X$ ¹² Supersedes ALDE 92C.

NODE=M015M5;LINKAGE=A

 $\eta\pi^+\pi^-$ MODE(For difficulties with MMS experiments, see the $a_2(1320)$ mini-review in the 1973 edition.)

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M015M6

NODE=M015M6

NODE=M015M6

1682 \pm 12 OUR AVERAGE

1685 \pm 10 \pm 20	AMELIN	00	VES		37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1680 \pm 15	FUKUI	88	SPEC	0	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1700 \pm 47	¹³ ANDERSON	69	MMS	-	16 $\pi^- p$ backward
1632 \pm 15	^{13,14} FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow \rho MM$
1700 \pm 15	^{13,14} FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow \rho MM$
1748 \pm 15	^{13,14} FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow \rho MM$

OCCUR=2

OCCUR=3

¹³ Seen in 2.5-3 GeV/c $\bar{p}p$. $2\pi^+ 2\pi^-$, with 0, 1, 2 $\pi^+ \pi^-$ pairs in ρ band not seen by OREN 74 (2.3 GeV/c $\bar{p}p$) with more statistics. (Jan. 1976)¹⁴ Not seen by BOWEN 72.

NODE=M015M6;LINKAGE=R

NODE=M015M6;LINKAGE=N

 $\rho_3(1690)$ WIDTH

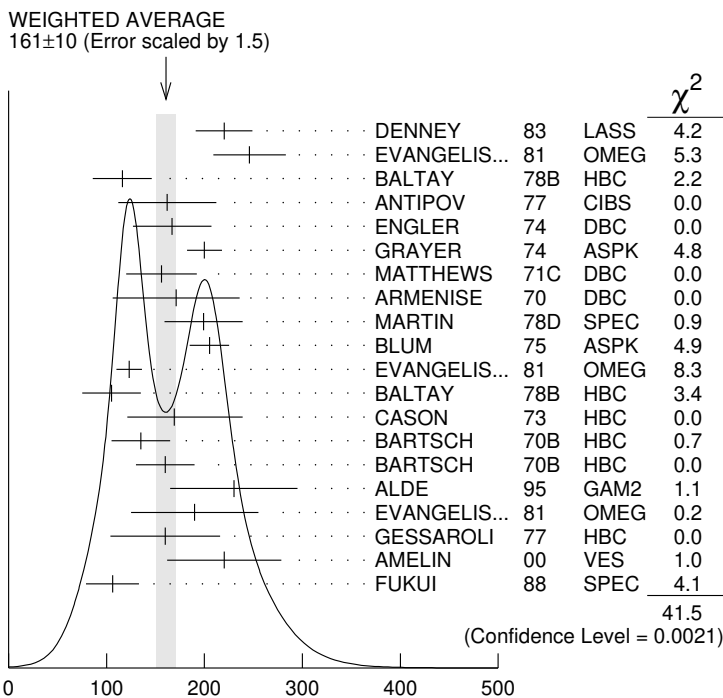
NODE=M015210

2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

VALUE (MeV)	DOCUMENT ID
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161 \pm 10 OUR AVERAGE Includes data from the 5 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.

NODE=M015W
 NODE=M015W



$\rho_3(1690)$ width, 2π , $K\bar{K}$, and $K\bar{K}\pi$ modes (MeV)

2 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015W1
NODE=M015W1

186±14 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

220±29		DENNEY	83	LASS	10 $\pi^+ N$
246±37		EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 2\pi p$
116±30	476	BALTAY	78B	HBC	0 15 $\pi^+ p \rightarrow \pi^+ \pi^- n$
162±50	175	15 ANTIPOV	77	CIBS	0 25 $\pi^- p \rightarrow p3\pi$
167±40	600	ENGLER	74	DBC	0 6 $\pi^+ n \rightarrow \pi^+ \pi^- p$
200±18		16 GRAYER	74	ASPK	0 17 $\pi^- p \rightarrow \pi^+ \pi^- n$
156±36		MATTHEWS	71C	DBC	0 7 $\pi^+ N$
171±65		ARMENISE	70	DBC	0 9 $\pi^+ d$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
322±35		17 CORDEN	79	OMEG	12-15 $\pi^- p \rightarrow n2\pi$
240±30		16,18 ESTABROOKS	75	RVUE	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
180±30	122	BARTSCH	70B	HBC	8 $\pi^+ p \rightarrow N2\pi$
267 ⁺⁷² ₋₄₆		STUNTEBECK	70	HDBC	0 8 $\pi^- p$, 5.4 $\pi^+ d$
188±49		ARMENISE	68	DBC	0 5.1 $\pi^+ d$
180±40		GOLDBERG	65	HBC	0 6 $\pi^+ d$, 8 $\pi^- p$

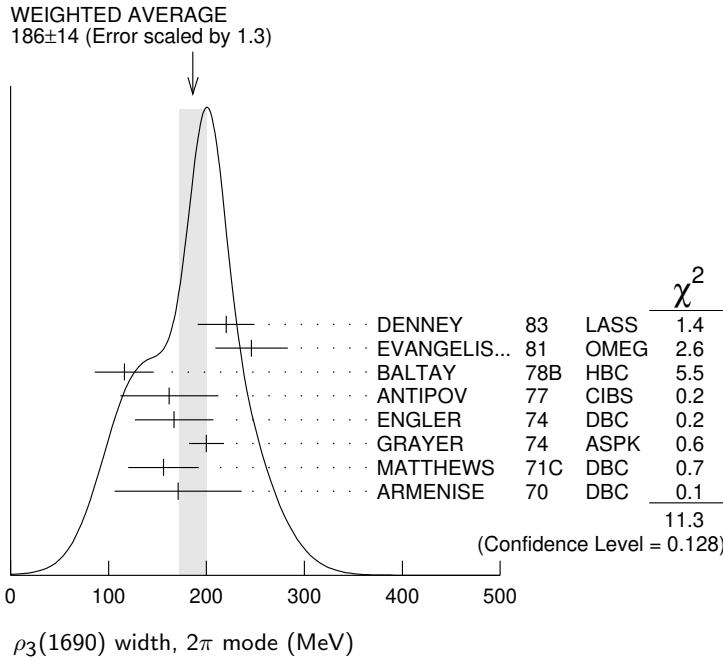
¹⁵Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶Uses same data as HYAMS 75 and BECKER 79.

¹⁷From a phase shift solution containing a $f_2'(1525)$ width two times larger than the $K\bar{K}$ result.

¹⁸From phase-shift analysis. Error takes account of spread of different phase-shift solutions.

NODE=M015W1;LINKAGE=T
NODE=M015W1;LINKAGE=G
NODE=M015W1;LINKAGE=M
NODE=M015W1;LINKAGE=I



$K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M015W2
NODE=M015W2

204±18 OUR AVERAGE

199±40	6000	¹⁹ MARTIN	78D	SPEC	10 $\pi^- p \rightarrow K_S^0 K^- p$
205±20		BLUM	75	ASPK 0	18.4 $\pi^- p \rightarrow n K^+ K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
219±4		ALPER	80	CNTR 0	62 $\pi^- p \rightarrow K^+ K^- n$
186±11		²⁰ COSTA	80	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
112±60		ADERHOLZ	69	HBC +	8 $\pi^+ p \rightarrow K\bar{K}\pi$

¹⁹ From a fit to $J^P = 3^-$ partial wave.

²⁰ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.

NODE=M015W2;LINKAGE=P
NODE=M015W2;LINKAGE=L

$(4\pi)^\pm$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M015W3
NODE=M015W3

129±10 OUR AVERAGE

123±13		²¹ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p4\pi$
105±30	177	BALTAY	78B	HBC +	15 $\pi^+ p \rightarrow p4\pi$
169 ⁺⁷⁰ ₋₄₈		CASON	73	HBC -	8,18.5 $\pi^- p$
135±30	144	BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N4\pi$
160±30	102	BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N2\rho$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
230±28		²² EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p4\pi$
184±33		²³ EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow p4\pi$
150	66	²⁴ KLIGER	74	HBC -	4.5 $\pi^- p \rightarrow p4\pi$
106±25		THOMPSON	74	HBC +	13 $\pi^+ p$
125 ⁺⁸³ ₋₃₅		²⁴ CASON	73	HBC -	8,18.5 $\pi^- p$
130±30		HOLMES	72	HBC +	10-12 $K^+ p$
180±30	90	²⁴ BARTSCH	70B	HBC +	8 $\pi^+ p \rightarrow N a_2 \pi$
100±35		BALTAY	68	HBC +	7, 8.5 $\pi^+ p$

²¹ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²² From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²³ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

²⁴ From $\rho^\pm \rho^0$ mode.

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NODE=M015W3;LINKAGE=A
NODE=M015W3;LINKAGE=B
NODE=M015W3;LINKAGE=C
NODE=M015W3;LINKAGE=F

$\omega\pi$ MODE

VALUE (MeV) _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
 The data in this block is included in the average printed for a previous datablock.

190±40 OUR AVERAGE

230±65	²⁵ ALDE	95	GAM2	38	$\pi^- p \rightarrow \omega\pi^0 n$
190±65	EVANGELIS...	81	OMEG -	12	$\pi^- p \rightarrow \omega\pi p$
160±56	GESSAROLI	77	HBC	11	$\pi^- p \rightarrow \omega\pi p$
● ● ●	We do not use the following data for averages, fits, limits, etc. ● ● ●				
89±25	THOMPSON	74	HBC +	13	$\pi^+ p$
130 ⁺⁷³ ₋₄₃	BARNHAM	70	HBC +	10	$K^+ p \rightarrow \omega\pi X$

²⁵ Supersedes ALDE 92C.

NODE=M015W5
 NODE=M015W5

NODE=M015W5;LINKAGE=A

 $\eta\pi^+\pi^-$ MODE

(For difficulties with MMS experiments, see the $a_2(1320)$ mini-review in the 1973 edition.)

VALUE (MeV) _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
 The data in this block is included in the average printed for a previous datablock.

130±40 OUR AVERAGE Error includes scale factor of 1.8.

220±30±50	AMELIN	00	VES	37	$\pi^- p \rightarrow \eta\pi^+\pi^- n$
106±27	FUKUI	88	SPEC 0	8.95	$\pi^- p \rightarrow \eta\pi^+\pi^- n$
● ● ●	We do not use the following data for averages, fits, limits, etc. ● ● ●				
195	²⁶ ANDERSON	69	MMS -	16	$\pi^- p$ backward
< 21	26,27 FOCACCI	66	MMS -	7-12	$\pi^- p \rightarrow pMM$
< 30	26,27 FOCACCI	66	MMS -	7-12	$\pi^- p \rightarrow pMM$
< 38	26,27 FOCACCI	66	MMS -	7-12	$\pi^- p \rightarrow pMM$

²⁶ Seen in 2.5-3 GeV/c $\bar{p}p$. $2\pi^+2\pi^-$, with 0, 1, 2 $\pi^+\pi^-$ pairs in ρ^0 band not seen by OREN 74 (2.3 GeV/c $\bar{p}p$) with more statistics. (Jan. 1979)

²⁷ Not seen by BOWEN 72.

NODE=M015W6

NODE=M015W6

NODE=M015W6

OCCUR=2

OCCUR=3

NODE=M015W6;LINKAGE=R

NODE=M015W6;LINKAGE=N

 $\rho_3(1690)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 4π	(71.1 ± 1.9) %	
Γ_2 $\pi^\pm\pi^+\pi^-\pi^0$	(67 ± 22) %	
Γ_3 $\omega\pi$	(16 ± 6) %	
Γ_4 $\pi\pi$	(23.6 ± 1.3) %	
Γ_5 $K\bar{K}\pi$	(3.8 ± 1.2) %	
Γ_6 $K\bar{K}$	(1.58 ± 0.26) %	1.2
Γ_7 $\eta\pi^+\pi^-$	seen	
Γ_8 $\rho(770)\eta$	seen	
Γ_9 $\pi\pi\rho$	seen	
Γ_{10} $a_2(1320)\pi$	seen	
Γ_{11} $\rho\rho$	seen	
Γ_{12} $\phi\pi$		
Γ_{13} $\eta\pi$		
Γ_{14} $\pi^\pm 2\pi^+ 2\pi^- \pi^0$		

NODE=M015215;NODE=M015

DESIG=2

DESIG=11

DESIG=7

DESIG=1

DESIG=3

DESIG=4

DESIG=13

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=10

DESIG=12

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 10 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 14.7$ for 7 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_4	-77		
x_5	-74	17	
x_6	-15	2	0
	x_1	x_4	x_5

$\rho_3(1690)$ BRANCHING RATIOS

NODE=M015220

$\Gamma(\pi\pi)/\Gamma_{total}$ Γ_4/Γ

VALUE DOCUMENT ID TECN CHG COMMENT

0.236±0.013 OUR FIT

0.243±0.013 OUR AVERAGE

0.259 ^{+0.018} _{-0.019}	BECKER	79	ASPK	0	17 $\pi^- p$ polarized
0.23 ±0.02	CORDEN	79	OMEG		12-15 $\pi^- p \rightarrow n2\pi$
0.22 ±0.04	²⁸ MATTHEWS	71C	HDBC	0	7 $\pi^+ n \rightarrow \pi^- p$
0.245±0.006	²⁹ ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$

²⁸ One-pion-exchange model used in this estimation.
²⁹ From phase-shift analysis of HYAMS 75 data.

NODE=M015R1
 NODE=M015R1

NODE=M015R1;LINKAGE=P
 NODE=M015R1;LINKAGE=G

$\Gamma(\pi\pi)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$ Γ_4/Γ_2

VALUE DOCUMENT ID TECN CHG COMMENT

0.35±0.11 CASON 73 HBC - 8,18.5 $\pi^- p$

••• We do not use the following data for averages, fits, limits, etc. •••

<0.2	HOLMES	72	HBC	+	10-12 $K^+ p$
<0.12	BALLAM	71B	HBC	-	16 $\pi^- p$

NODE=M015R2
 NODE=M015R2

$\Gamma(\pi\pi)/\Gamma(4\pi)$ Γ_4/Γ_1

VALUE DOCUMENT ID TECN CHG COMMENT

0.332±0.026 OUR FIT Error includes scale factor of 1.1.

0.30 ±0.10 BALTAY 78B HBC 0 15 $\pi^+ p \rightarrow p4\pi$

NODE=M015R3
 NODE=M015R3

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_6/Γ_4

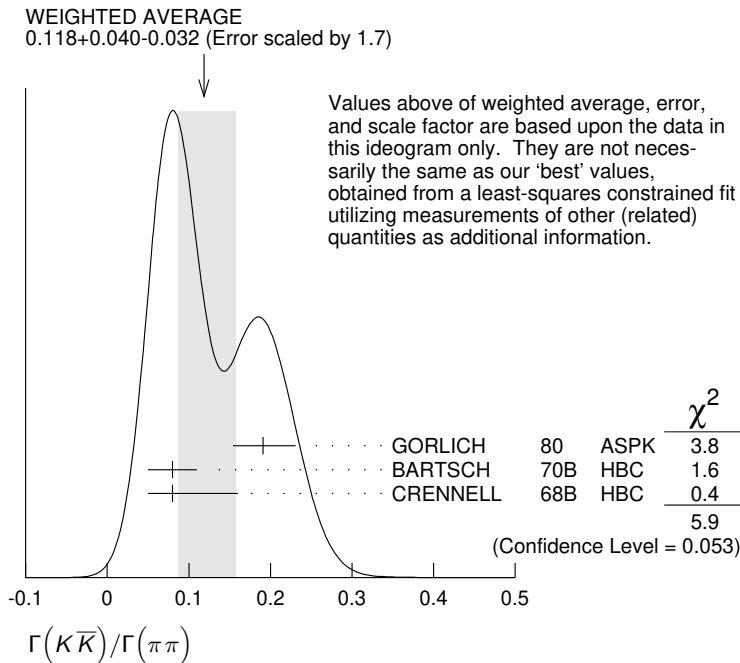
VALUE DOCUMENT ID TECN CHG COMMENT

0.067±0.011 OUR FIT Error includes scale factor of 1.2.

0.118^{+0.040}_{-0.032} OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.

0.191 ^{+0.040} _{-0.037}	GORLICH	80	ASPK	0	17,18 $\pi^- p$ polarized
0.08 ±0.03	BARTSCH	70B	HBC	+	8 $\pi^+ p$
0.08 ^{+0.08} _{-0.03}	CRENNELL	68B	HBC		6.0 $\pi^- p$

NODE=M015R4
 NODE=M015R4



$\Gamma(K\bar{K}\pi)/\Gamma(\pi\pi)$ Γ_5/Γ_4

VALUE DOCUMENT ID TECN CHG COMMENT

0.16±0.05 OUR FIT

0.16±0.05 ³⁰BARTSCH 70B HBC + 8 $\pi^+ p$

³⁰ Increased by us to correspond to $B(\rho_3(1690) \rightarrow \pi\pi)=0.24$.

NODE=M015R5
 NODE=M015R5

NODE=M015R5;LINKAGE=A

$$\frac{\Gamma(\pi^+\pi^0) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{(\Gamma_9 + \Gamma_{10} + \Gamma_{11})}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.94 ± 0.09 OUR AVERAGE				
0.96 ± 0.21	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.88 ± 0.15	BALLAM	71B	HBC	- 16 $\pi^- p$
1 ± 0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
consistent with 1	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R6
NODE=M015R6

$$\frac{\Gamma(\rho\rho)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{11}}{\Gamma_2}$$

VALUE	EVT5	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.12 ± 0.11		BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.56	66	KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p4\pi$
0.13 ± 0.09	31	THOMPSON	74	HBC	+ 13 $\pi^+ p$
0.7 ± 0.15		BARTSCH	70B	HBC	+ 8 $\pi^+ p$

NODE=M015R7
NODE=M015R7

³¹ $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R7;LINKAGE=T

$$\frac{\Gamma(\rho\rho)}{[\Gamma(\pi^+\pi^0) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]} \quad \frac{\Gamma_{11}}{(\Gamma_9 + \Gamma_{10} + \Gamma_{11})}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.48 ± 0.16	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R8
NODE=M015R8

$$\frac{\Gamma(a_2(1320)\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{10}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.66 ± 0.08	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.36 ± 0.14	32 THOMPSON	74	HBC	+ 13 $\pi^+ p$
not seen	CASON	73	HBC	- 8,18.5 $\pi^- p$
0.6 ± 0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
0.6	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R9
NODE=M015R9

³² $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R9;LINKAGE=T

$$\frac{\Gamma(\omega\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_3}{\Gamma_2}$$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.23 ± 0.05 OUR AVERAGE		Error includes scale factor of 1.2.			
0.33 ± 0.07		THOMPSON	74	HBC	+ 13 $\pi^+ p$
0.12 ± 0.07		BALLAM	71B	HBC	- 16 $\pi^- p$
0.25 ± 0.10		BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$
0.25 ± 0.10		JOHNSTON	68	HBC	- 7.0 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.11	95	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
< 0.09		KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p4\pi$

NODE=M015R10
NODE=M015R10

$$\frac{\Gamma(\phi\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{12}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.11	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R11
NODE=M015R11

$$\frac{\Gamma(\pi^+2\pi^+2\pi^-\pi^0)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{14}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.15	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R12
NODE=M015R12

$$\frac{\Gamma(\eta\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{13}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.02	THOMPSON	74	HBC	+ 13 $\pi^+ p$

NODE=M015R13
NODE=M015R13

$$\frac{\Gamma(K\bar{K})}{\Gamma_{\text{total}}} \quad \frac{\Gamma_6}{\Gamma}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.0158 ± 0.0026 OUR FIT	Error includes scale factor of 1.2.			
0.0130 ± 0.0024 OUR AVERAGE				

NODE=M015R14
NODE=M015R14

0.013 ± 0.003	COSTA	80	OMEG	0	10 $\pi^- p \rightarrow K^+ K^- n$
0.013 ± 0.004	33 MARTIN	78B	SPEC	-	10 $\pi p \rightarrow K_S^0 K^- p$

³³ From $(\Gamma_4\Gamma_6)^{1/2} = 0.056 \pm 0.034$ assuming $B(\rho_3(1690) \rightarrow \pi\pi) = 0.24$.

NODE=M015R14;LINKAGE=B

$$\frac{\Gamma(\omega\pi)}{[\Gamma(\omega\pi) + \Gamma(\rho\rho)]}$$

$$\frac{\Gamma_3}{(\Gamma_3 + \Gamma_{11})}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M015R16
NODE=M015R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.22±0.08	CASON	73	HBC	-	8,18.5 $\pi^- p$
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$$\frac{\Gamma(\eta\pi^+\pi^-)}{\Gamma_{\text{total}}}$$

$$\frac{\Gamma_7}{\Gamma}$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M015R17
NODE=M015R17

seen	FUKUI	88	SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
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$$\frac{\Gamma(a_2(1320)\pi)}{\Gamma(\rho(770)\eta)}$$

$$\frac{\Gamma_{10}}{\Gamma_8}$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M015R18
NODE=M015R18

5.5±2.0	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
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$\rho_3(1690)$ REFERENCES

NODE=M015

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP	REFID=44371
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21665
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20738
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
MARTIN	78B	NP B140 158	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=21273
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=21272
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP	REFID=21651
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
KLIGER	74	SJNP 19 428	G.K. Kliger <i>et al.</i>	(ITEP)	REFID=21648
		Translated from YAF 19 839.			
OREN	74	NP B71 189	Y. Oren <i>et al.</i>	(ANL, OXF)	REFID=20221
THOMPSON	74	NP B69 220	G. Thompson <i>et al.</i>	(PURD)	REFID=21650
CASON	73	PR D7 1971	N.M. Cason <i>et al.</i>	(NDAM)	REFID=20606
BOWEN	72	PRL 29 890	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21711
HOLMES	72	PR D6 3336	R. Holmes <i>et al.</i>	(ROCH)	REFID=21639
BALLAM	71B	PR D3 2606	J. Ballam <i>et al.</i>	(SLAC)	REFID=21630
MATTHEWS	71C	NP B33 1	J.A.J. Matthews <i>et al.</i>	(TNTO, WISC) JP	REFID=21633
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)	REFID=20693
BARNHAM	70	PRL 24 1083	K.W.J. Barnham <i>et al.</i>	(BIRM)	REFID=21624
BARTSCH	70B	NP B22 109	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN)	REFID=21625
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=20590
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)	REFID=20696
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)	REFID=20687
ANDERSON	69	PRL 22 1390	E.W. Anderson <i>et al.</i>	(BNL, CMU)	REFID=20795
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+) I	REFID=20054
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I	REFID=21531
CASO	68	NC 54A 983	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=20586
CRENNELL	68B	PL 28B 136	D.J. Crennell <i>et al.</i>	(BNL)	REFID=21616
JOHNSTON	68	PRL 20 1414	T.F. Johnston <i>et al.</i>	(TNTO, WISC) IJP	REFID=21617
FOCACCI	66	PRL 17 890	M.N. Focacci <i>et al.</i>	(CERN)	REFID=20402
GOLDBERG	65	PL 17 354	M. Goldberg <i>et al.</i>	(CERN, EPOL, ORSAY+)	REFID=21601

$\rho(1700)$

$$I^G(J^{PC}) = 1^+(1^-)$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M065

NODE=M065

NODE=M065205

NODE=M065M0

NODE=M065M0

→ UNCHECKED ←

NODE=M065M6

NODE=M065M6

 $\rho(1700)$ MASS **$\eta\rho^0$ AND $\pi^+\pi^-$ MODES**

VALUE (MeV)

DOCUMENT ID

 1720 ± 20 OUR ESTIMATE **$\eta\rho^0$ MODE**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1834 ± 12	13.4k	¹ GRIBANOV	20	CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1840 ± 10	7.4k	² ACHASOV	18	SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1740 ± 20		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701 ± 15		³ FUKUI	88	SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.³ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+ \pi$ background. From a two Breit-Wigner fit.

NODE=M065M6;LINKAGE=B

NODE=M065M6;LINKAGE=A

NODE=M065M;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1604.66 ± 30.8	34M	¹ IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$	
1770.54 ± 5.49		² BARTOS	17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
1718.50 ± 65.44		³ BARTOS	17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
1766.80 ± 52.36		⁴ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$	
1644 ± 36	20k	⁵ LEES	17C	BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$	
1780 ± 20	⁺¹⁵ ⁻²⁰	63.5k	⁶ ABRAMOWICZ	12	ZEUS	$e p \rightarrow e\pi^+\pi^- p$
1861 ± 17			⁷ LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
1728 ± 17	± 89	5.4M	^{8,9} FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1780 ⁺³⁷ ⁻²⁹			¹⁰ ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1719 ± 15			¹⁰ BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1730 ± 30			CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1768 ± 21			BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1745.7 ± 91.9			DUBNICKA	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1546 ± 26			GESHKEN...	89	RVUE	
1650			¹¹ ERKAL	85	RVUE	20–70 $\gamma p \rightarrow \gamma\pi$
1550 ± 70			ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+\pi^- p$
1590 ± 20			¹² ASTON	80	OMEG	20–70 $\gamma p \rightarrow p2\pi$
1600 ± 10			¹³ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C2\pi$
1598 ⁺²⁴ ⁻²²			BECKER	79	ASPK	17 $\pi^- p$ polarized
1659 ± 25			¹¹ LANG	79	RVUE	
1575			¹¹ MARTIN	78C	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1610 ± 30			¹¹ FROGGATT	77	RVUE	17 $\pi^- p \rightarrow \pi^+\pi^- n$
1590 ± 20			¹⁴ HYAMS	73	ASPK	17 $\pi^- p \rightarrow \pi^+\pi^- n$

¹ From a fit of the pion form factor using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. The fit uses also data from CMD-2 and DM2 experiments. Systematic errors not estimated.² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

OCCUR=2

NODE=M065M1;LINKAGE=F

NODE=M065M1;LINKAGE=C

NODE=M065M1;LINKAGE=D

- ⁴ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of FUJIKAWA 08.
- ⁵ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.
- ⁶ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.
- ⁷ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
- ⁸ $|F_\pi(0)|^2$ fixed to 1.
- ⁹ From the GOUNARIS 68 parametrization of the pion form factor.
- ¹⁰ T-matrix pole.
- ¹¹ From phase shift analysis of HYAMS 73 data.
- ¹² Simple relativistic Breit-Wigner fit with constant width.
- ¹³ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.
- ¹⁴ Included in BECKER 79 analysis.

NODE=M065M1;LINKAGE=E

NODE=M065M1;LINKAGE=A

NODE=M065M1;LINKAGE=AB

NODE=M065M1;LINKAGE=LE

NODE=M065M1;LINKAGE=FU

NODE=M065M1;LINKAGE=GO

NODE=M065M;LINKAGE=QQ

NODE=M065M;LINKAGE=P

NODE=M065M;LINKAGE=M

NODE=M065M;LINKAGE=R

NODE=M065M;LINKAGE=H

NODE=M065M8

NODE=M065M8

 $\pi\omega$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1723 ± 2		¹ ACHASOV	23A	SND	$e^+e^- \rightarrow \omega\pi^0$
1708 ± 41	7815	² ACHASOV	13	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1550 to 1620		³ ACHASOV	00I	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710		⁴ ACHASOV	00I	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710 ± 90		ACHASOV	97	RVUE	$e^+e^- \rightarrow \omega\pi^0$

OCCUR=2

¹ From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

³ Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.

⁴ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

NODE=M065M8;LINKAGE=A

NODE=M065M8;LINKAGE=AC

NODE=M065M;LINKAGE=I1

NODE=M065M;LINKAGE=I2

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1688.7 ± 3.1 ^{+141.1} _{-1.3}		¹ ALBRECHT	20	RVUE	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1541 ± 12 ± 33	190k	² AAJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1740.8 ± 22.2	27k	³ ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
1582 ± 36	1600	CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ T-matrix pole, 2 poles, 3 channels, including $\pi\pi$ scattering data from HYAMS 75.

² Using the GOUNARIS 68 parameterization with a fixed width. Value is average using different $K\pi$ S-wave parameterizations in fit.

³ K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

NODE=M065M2;LINKAGE=D

NODE=M065M2;LINKAGE=A

NODE=M065M2;LINKAGE=AN

 $2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1851 ⁺²⁷ ₋₂₄		ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570 ± 20		¹ CORDIER	82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520 ± 30		² ASTON	81E	OMEG	20–70 $\gamma p \rightarrow p4\pi$
1654 ± 25		³ DIBIANCA	81	DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
1666 ± 39		¹ BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
1500		⁴ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
1570 ± 60	65	⁵ ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p4\pi$
1550 ± 60		² CONVERSI	74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1550 ± 50	160	SCHACHT	74	STRC	5.5–9 $\gamma p \rightarrow p4\pi$
1450 ± 100	340	SCHACHT	74	STRC	9–18 $\gamma p \rightarrow p4\pi$
1430 ± 50	400	BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

NODE=M065M4

NODE=M065M4

OCCUR=2

¹ Simple relativistic Breit-Wigner fit with model dependent width.

² Simple relativistic Breit-Wigner fit with constant width.

³ One peak fit result.

⁴ Parameters roughly estimated, not from a fit.

⁵ Skew mass distribution compensated by Ross-Stodolsky factor.

NODE=M065M;LINKAGE=A

NODE=M065M4;LINKAGE=M

NODE=M065M;LINKAGE=O

NODE=M065M;LINKAGE=C

NODE=M065M;LINKAGE=D

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1660±30	ATKINSON	85B	OMEG 20-70 γp
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NODE=M065M5
NODE=M065M5

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1730±34	¹ FRABETTI	04	E687 $\gamma p \rightarrow 3\pi^+3\pi^-p$
1783±15	CLEGG	90	RVUE $e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

¹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M7
NODE=M065M7

NODE=M065M;LINKAGE=PI

 $m_{\rho(1700)^0} - m_{\rho(1700)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

-48.30±83.81	¹ BARTOS	17A	RVUE $e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
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¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M065DM

NODE=M065DM

NODE=M065DM;LINKAGE=A

 $\rho(1700)$ WIDTH

NODE=M065210

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)	DOCUMENT ID
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250±100 OUR ESTIMATE

NODE=M065W0
NODE=M065W0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M065W6
NODE=M065W6

• • • We do not use the following data for averages, fits, limits, etc. • • •

47±19	13.4k	¹ GRIBANOV	20	CMD3	1.1-2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
132±40	7.4k	² ACHASOV	18	SND	1.22-2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
150±30		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282±44		³ FUKUI	88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

³ Assuming $\rho^+f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.

NODE=M065W6;LINKAGE=B

NODE=M065W6;LINKAGE=A

NODE=M065W;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M065W1
NODE=M065W1

• • • We do not use the following data for averages, fits, limits, etc. • • •

249.39±52.24	34M	¹ IGNATOV	24	CMD3	$e^+e^- \rightarrow \pi^+\pi^-$
268.98±11.40		² BARTOS	17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
489.58±16.95		³ BARTOS	17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
414.71±119.48		⁴ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
109 ± 19	20k	⁵ LEES	17C	BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
310 ± 30	$\frac{+25}{-35}$ 63.5k	⁶ ABRAMOWICZ12		ZEUS	$e p \rightarrow e\pi^+\pi^-p$
316 ± 26		⁷ LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 ± 21	$\frac{+89}{-26}$ 5.4M	^{8,9} FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
275 ± 45		¹⁰ ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		¹⁰ BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
400 ± 100		CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
224 ± 22		BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$

OCCUR=2

242.5 ± 163.0		DUBNICKA	89	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
620 ± 60		GESHKEN...	89	RVUE	
<315		¹¹ ERKAL	85	RVUE	20-70 $\gamma p \rightarrow \gamma \pi$
280 + 30 - 80		ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+ \pi^- p$
230 ± 80		¹² ASTON	80	OMEG	20-70 $\gamma p \rightarrow p 2\pi$
283 ± 14		¹³ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C 2\pi$
175 + 98 - 53		BECKER	79	ASPK	17 $\pi^- p$ polarized
232 ± 34		¹¹ LANG	79	RVUE	
340		¹¹ MARTIN	78C	RVUE	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
300 ± 100		¹¹ FROGGATT	77	RVUE	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
180 ± 50		¹⁴ HYAMS	73	ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$

¹ From a fit of the pion form factor using the GOUNARIS 68 parametrization with the complex phase of the $\rho - \omega$ interference leaving $\rho(1450)$, $\rho(1700)$ resonances as free parameters of the fit. The fit uses also data from CMD-2 and DM2 experiments. Systematic errors not estimated.

² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

⁴ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.

⁵ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.

⁶ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho - \omega$ interference.

⁷ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁸ $|F_\pi(0)|^2$ fixed to 1.

⁹ From the GOUNARIS 68 parametrization of the pion form factor.

¹⁰ T-matrix pole.

¹¹ From phase shift analysis of HYAMS 73 data.

¹² Simple relativistic Breit-Wigner fit with constant width.

¹³ An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

¹⁴ Included in BECKER 79 analysis.

NODE=M065W1;LINKAGE=F

NODE=M065W1;LINKAGE=C

NODE=M065W1;LINKAGE=D

NODE=M065W1;LINKAGE=E

NODE=M065W1;LINKAGE=A

NODE=M065W1;LINKAGE=AB

NODE=M065W1;LINKAGE=LE

NODE=M065W1;LINKAGE=FU

NODE=M065W1;LINKAGE=GO

NODE=M065W;LINKAGE=QQ

NODE=M065W;LINKAGE=P

NODE=M065W;LINKAGE=M

NODE=M065W;LINKAGE=R

NODE=M065W;LINKAGE=H

NODE=M065W2

NODE=M065W2

K \bar{K} MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

150.9 ± 2.5 ⁺⁶⁰ _{-10.6}		¹ ALBRECHT	20	RVUE	0.9 $\bar{p} p \rightarrow K^+ K^- \pi^0$
187.2 ± 26.7	27k	² ABELE	99D	CBAR ±	0.0 $\bar{p} p \rightarrow K^+ K^- \pi^0$
265 ± 120	1600	CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ T-matrix pole, 2 poles, 3 channels, including $\pi\pi$ scattering data from HYAMS 75.

² K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

NODE=M065W2;LINKAGE=A

NODE=M065W2;LINKAGE=AN

2 ($\pi^+ \pi^-$) MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

510 ± 40		¹ CORDIER	82	DM1	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
400 ± 50		² ASTON	81E	OMEG	20-70 $\gamma p \rightarrow p 4\pi$
400 ± 146		³ DIBIANCA	81	DBC	$\pi^+ d \rightarrow p p 2(\pi^+ \pi^-)$
700 ± 160		¹ BACCI	80	FRAG	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
100	34	KILLIAN	80	SPEC	11 $e^- p \rightarrow 2(\pi^+ \pi^-)$
600		⁴ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C 4\pi^\pm$
340 ± 160	65	⁵ ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p 4\pi$
360 ± 100		² CONVERSI	74	OSPK	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
400 ± 120	160	⁶ SCHACHT	74	STRC	5.5-9 $\gamma p \rightarrow p 4\pi$
850 ± 200	340	⁶ SCHACHT	74	STRC	9-18 $\gamma p \rightarrow p 4\pi$
650 ± 100	400	BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p 4\pi$

¹ Simple relativistic Breit-Wigner fit with model-dependent width.

² Simple relativistic Breit-Wigner fit with constant width.

³ One peak fit result.

⁴ Parameters roughly estimated, not from a fit.

⁵ Skew mass distribution compensated by Ross-Stodolsky factor.

⁶ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M065W4

NODE=M065W4

OCCUR=2

NODE=M065W;LINKAGE=A

NODE=M065W4;LINKAGE=M

NODE=M065W;LINKAGE=O

NODE=M065W;LINKAGE=C

NODE=M065W;LINKAGE=D

NODE=M065W;LINKAGE=E

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
300±50	ATKINSON	85B	OMEG 20-70 $\gamma\rho$

NODE=M065W5
 NODE=M065W5

 $\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
371±3	¹ ACHASOV	23A	SND $e^+e^- \rightarrow \omega\pi^0$
350 to 580	² ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	³ ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M065W9
 NODE=M065W9

••• We do not use the following data for averages, fits, limits, etc. •••

¹From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

²Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.

³Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

OCCUR=2

NODE=M065W9;LINKAGE=A

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
315±100	¹ FRABETTI	04	E687 $\gamma\rho \rightarrow 3\pi^+3\pi^-\rho$
285±20	CLEGG	90	RVUE $e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

NODE=M065W7
 NODE=M065W7

••• We do not use the following data for averages, fits, limits, etc. •••

¹From a fit with two resonances with the JACOB 72 continuum.

NODE=M065W;LINKAGE=PI

 $\Gamma_{\rho(1700)^0} - \Gamma_{\rho(1700)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
74.87±120.67	¹ BARTOS	17A	RVUE $e^+e^- \rightarrow \pi^+\pi^-, \tau^- \rightarrow \pi^-\pi^0\nu_\tau$

NODE=M065DW

NODE=M065DW

••• We do not use the following data for averages, fits, limits, etc. •••

¹Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M065DW;LINKAGE=A

 $\rho(1700)$ DECAY MODES

NODE=M065215;NODE=M065

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2(\pi^+\pi^-)$	seen
Γ_3 $\rho\pi\pi$	seen
Γ_4 $\rho^0\pi^+\pi^-$	seen
Γ_5 $\rho^0\pi^0\pi^0$	
Γ_6 $\rho^\pm\pi^\mp\pi^0$	seen
Γ_7 $a_1(1260)\pi$	seen
Γ_8 $h_1(1170)\pi$	seen
Γ_9 $\pi(1300)\pi$	seen
Γ_{10} $\rho\rho$	seen
Γ_{11} $\pi^+\pi^-$	seen
Γ_{12} $\pi\pi$	seen
Γ_{13} $K\bar{K}^*(892)+$ c.c.	seen
Γ_{14} $\eta\rho$	seen
Γ_{15} $a_2(1320)\pi$	not seen
Γ_{16} $K\bar{K}$	seen
Γ_{17} e^+e^-	seen
Γ_{18} $\pi^0\omega$	seen
Γ_{19} $\pi^0\gamma$	not seen
Γ_{20} $f_0(1500)\gamma$	not seen

DESIG=20

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=15;OUR EST;→ UNCHECKED ←

DESIG=16;OUR EST;→ UNCHECKED ←

DESIG=17;OUR EST;→ UNCHECKED ←

DESIG=18;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EST;→ UNCHECKED ←

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=194

DESIG=195

$\rho(1700) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M065225

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the cross-section into channel i in e^+e^- annihilation.

NODE=M065225

 $\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2\Gamma_{17}/\Gamma$ NODE=M065G2
NODE=M065G2

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ± 0.2	DEL COURT	81B DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
2.83 ± 0.42	BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$

 $\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{11}\Gamma_{17}/\Gamma$ NODE=M065G4
NODE=M065G4

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13	¹ DIEKMAN	88 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
0.029 ^{+0.016} _{-0.012}	KURDADZE	83 OLYA	0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

¹ Using total width = 220 MeV.

NODE=M065G4;LINKAGE=B

 $\Gamma(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_{17}/\Gamma$ NODE=M065G10
NODE=M065G10

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.305 ± 0.071	¹ BIZOT	80 DM1	e^+e^-

¹ Model dependent.

NODE=M065G;LINKAGE=M

 $\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{14}\Gamma_{17}/\Gamma$ NODE=M065G11
NODE=M065G11

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35 ± 0.53 ± 0.08	13.4k	¹ GRIBANOV	20 CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
84 ± 26 ± 4		² LEES	18 BABR	$e^+e^- \rightarrow \eta\pi^+\pi^-$
7 ± 3		ANTONELLI	88 DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

NODE=M065G11;LINKAGE=B

² Includes non-resonant contribution. The selected fit model includes three ρ excited states. Model uncertainty is 80%.

NODE=M065G11;LINKAGE=A

 $\Gamma(K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_{17}/\Gamma$ NODE=M065G5
NODE=M065G5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.035 ± 0.029	¹ BIZOT	80 DM1	e^+e^-

¹ Model dependent.

NODE=M065G5;LINKAGE=M

 $\Gamma(\rho\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_3\Gamma_{17}/\Gamma$ NODE=M065G12
NODE=M065G12

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.510 ± 0.090	¹ BIZOT	80 DM1	e^+e^-

¹ Model dependent.

NODE=M065G12;LINKAGE=M

 $\rho(1700) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M065240

 $\Gamma(\pi^0\omega)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_{17}/\Gamma$ NODE=M065R01
NODE=M065R01

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.09 ± 0.05	10.2k	¹ ACHASOV	16D SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.7 ± 0.4	7815	² ACHASOV	13 SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=4

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(700)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainty not estimated. Supersedes ACHASOV 13.

NODE=M065R01;LINKAGE=B

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M065R01;LINKAGE=AC

$$\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \qquad \Gamma_{14}/\Gamma \times \Gamma_{17}/\Gamma$$

VALUE (units 10^{-8}) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.3^{+3.8}_{-3.1} 7.4k ¹ACHASOV 18 SND 1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M065R00
NODE=M065R00

NODE=M065R00;LINKAGE=A

$\rho(1700)$ BRANCHING RATIOS

NODE=M065230

$$\Gamma(\rho\pi\pi)/\Gamma(4\pi) \qquad \Gamma_3/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.28±0.06 ¹ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R19
NODE=M065R19

NODE=M065R;LINKAGE=BL

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \qquad \Gamma_4/\Gamma_2$$

VALUE EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1.0 DELCOURT 81B DM1 $e^+e^- \rightarrow 2(\pi^+\pi^-)$

0.7 ±0.1 500 SCHACHT 74 STRC 5.5–18 $\gamma p \rightarrow p4\pi$

0.80 ¹BINGHAM 72B HBC 9.3 $\gamma p \rightarrow p4\pi$

¹The $\pi\pi$ system is in S-wave.

NODE=M065R1
NODE=M065R1

NODE=M065R1;LINKAGE=S

$$\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0) \qquad \Gamma_5/\Gamma_6$$

VALUE DOCUMENT ID TECN CHG COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.10 ATKINSON 85B OMEG 20–70 γp

<0.15 ATKINSON 82 OMEG 0 20–70 $\gamma p \rightarrow p4\pi$

NODE=M065R6
NODE=M065R6

$$\Gamma(a_1(1260)\pi)/\Gamma(4\pi) \qquad \Gamma_7/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.16±0.05 ¹ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R15
NODE=M065R15

NODE=M065R15;LINKAGE=BL

$$\Gamma(h_1(1170)\pi)/\Gamma(4\pi) \qquad \Gamma_8/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.17±0.06 ¹ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R16
NODE=M065R16

NODE=M065R16;LINKAGE=BL

$$\Gamma(\pi(1300)\pi)/\Gamma(4\pi) \qquad \Gamma_9/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.30±0.10 ¹ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R17
NODE=M065R17

NODE=M065R17;LINKAGE=BL

$$\Gamma(\rho\rho)/\Gamma(4\pi) \qquad \Gamma_{10}/\Gamma_1$$

VALUE DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.09±0.03 ¹ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

NODE=M065R18
NODE=M065R18

NODE=M065R18;LINKAGE=BL

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.108 \pm 0.017^{+0.162}_{-0.004}$	¹ ALBRECHT	20	RVUE	$0.9 \bar{p}p \rightarrow K^+ K^- \pi^0$
$0.287^{+0.043}_{-0.042}$	BECKER	79	ASPK	$17 \pi^- p$ polarized
0.15 to 0.30	² MARTIN	78C	RVUE	$17 \pi^- p \rightarrow \pi^+ \pi^- n$
<0.20	³ COSTA...	77B	RVUE	$e^+ e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	² FROGGATT	77	RVUE	$17 \pi^- p \rightarrow \pi^+ \pi^- n$
<0.15	⁴ EISENBERG	73	HBC	$5 \pi^+ p \rightarrow \Delta^{++} 2\pi$
0.25 ± 0.05	⁵ HYAMS	73	ASPK	$17 \pi^- p \rightarrow \pi^+ \pi^- n$

¹ Residue from T-matrix pole, 2 poles, 3 channels, Chew-Mandelstam functions and simplified analytic continuation for the 4π channel. Includes scattering data from HYAMS 75 and model-independent calculation of GARCIA-MARTIN 11A.

² From phase shift analysis of HYAMS 73 data.

³ Estimate using unitarity, time reversal invariance, Breit-Wigner.

⁴ Estimated using one-pion-exchange model.

⁵ Included in BECKER 79 analysis.

NODE=M065R5
NODE=M065R5

NODE=M065R5;LINKAGE=A

NODE=M065R5;LINKAGE=P
NODE=M065R5;LINKAGE=C
NODE=M065R5;LINKAGE=E
NODE=M065R5;LINKAGE=H

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{16}/Γ
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.007 \pm 0.006^{+0.041}_{-0.002}$	¹ ALBRECHT	20	RVUE	$0.9 \bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Residue from T-matrix pole, 2 poles, 3 channels, Chew-Mandelstam functions and simplified analytic continuation for the 4π channel. Includes scattering data from HYAMS 75 and model-independent calculation of GARCIA-MARTIN 11A.

NODE=M065R03
NODE=M065R03

NODE=M065R03;LINKAGE=A

 $\Gamma(\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ_2
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.13 ± 0.05	ASTON	80	OMEG	$20-70 \gamma p \rightarrow p 2\pi$
<0.14	¹ DAVIER	73	STRC	$6-18 \gamma p \rightarrow p 4\pi$
<0.2	² BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p 2\pi$

¹ Upper limit is estimate.

² 2σ upper limit.

NODE=M065R3
NODE=M065R3

NODE=M065R3;LINKAGE=E
NODE=M065R3;LINKAGE=S

 $\Gamma(\pi\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ_1
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.16 ± 0.04	^{1,2} ABELE	01B	CBAR	$0.0 \bar{p}n \rightarrow 5\pi$

¹ Using ABELE 97.

² $\omega\pi$ not included.

NODE=M065R20
NODE=M065R20

NODE=M065R;LINKAGE=LK
NODE=M065R20;LINKAGE=BL

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
possibly seen	COAN	04	CLEO	$\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

NODE=M065R21
NODE=M065R21

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(2(\pi^+\pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ_2
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.15 ± 0.03	¹ DELCOURT	81B	DM1	$e^+ e^- \rightarrow \bar{K} K \pi$

¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

NODE=M065R9
NODE=M065R9

NODE=M065R9;LINKAGE=D

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
possibly seen		AKHMETSHIN	00D	CMD2	$e^+ e^- \rightarrow \eta \pi^+ \pi^-$
<0.04		DONNACHIE	87B	RVUE	
<0.02	58	ATKINSON	86B	OMEG	$20-70 \gamma p$

NODE=M065R12
NODE=M065R12

$\Gamma(\eta\rho)/\Gamma(2(\pi^+\pi^-))$ Γ_{14}/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
0.123±0.027	DEL COURT	82	DM1 $e^+e^- \rightarrow \pi^+\pi^-$ MM
~0.1	ASTON	80	OMEG 20-70 γp

NODE=M065R8
 NODE=M065R8

 $\Gamma(\pi^+\pi^- \text{ neutrals})/\Gamma(2(\pi^+\pi^-))$ $(\Gamma_5+\Gamma_6+0.714\Gamma_{14})/\Gamma_2$

VALUE	DOCUMENT ID	TECN	COMMENT
2.6±0.4	¹ BALLAM	74	HBC 9.3 γp

NODE=M065R7
 NODE=M065R7

¹ Upper limit. Background not subtracted.

NODE=M065R7;LINKAGE=U

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

NODE=M065R14
 NODE=M065R14

 $\Gamma(K\bar{K})/\Gamma(2(\pi^+\pi^-))$ Γ_{16}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.015±0.010		¹ DEL COURT	81B	DM1	$e^+e^- \rightarrow \bar{K}K$
<0.04	95	BINGHAM	72B	HBC	0 9.3 γp

NODE=M065R4
 NODE=M065R4

¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

NODE=M065R4;LINKAGE=D

 $\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892)+c.c.)$ Γ_{16}/Γ_{13}

VALUE	DOCUMENT ID	TECN	COMMENT
0.052±0.026	BUON	82	DM1 $e^+e^- \rightarrow$ hadrons

NODE=M065R10
 NODE=M065R10

 $\Gamma(\pi^0\omega)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen		MATVIENKO	15	BELL $\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
seen	1.6k	ACHASOV	12	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
not seen	2382	AKHMETSHIN	03B	CMD2 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
seen		ACHASOV	97	RVUE $e^+e^- \rightarrow \omega\pi^0$

NODE=M065R13
 NODE=M065R13

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ACHASOV	10D	SND 1.075-2.0 $e^+e^- \rightarrow \pi^0\gamma$

NODE=M065R02
 NODE=M065R02

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. The width of the highest mass effective resonance is fixed at 315 MeV.

NODE=M065R02;LINKAGE=A

 $\Gamma(f_0(1500)\gamma)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ACHASOV	22	SND 1.17-2.00 $e^+e^- \rightarrow \eta\eta\gamma$

NODE=M065R04
 NODE=M065R04

¹ The 90% CL upper limit on the Born cross sections $\sigma(e^+e^- \rightarrow \phi(1680) \rightarrow f_2'(1525)\gamma \rightarrow \eta\eta\gamma)$ and $\sigma(e^+e^- \rightarrow \rho(1700) \rightarrow f_0(1500)\gamma \rightarrow \eta\eta\gamma)$ is 10.6 pb.

NODE=M065R04;LINKAGE=A

 $\rho(1700)$ REFERENCES

NODE=M065

IGNATOV	24	PR D109 112002	F.V. Ignatov <i>et al.</i>	(CMD-3 Collab.)	REFID=62672
ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=62428
ACHASOV	22	EPJ C82 168	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61655
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61028
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
GRIBANOV	20	JHEP 2001 112	S.S. Gribov <i>et al.</i>	(CMD-3 Collab.)	REFID=60620
ACHASOV	18	PR D97 012008	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=58785
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58900
BARTOS	17	PR D96 113004	E. Bartos <i>et al.</i>		REFID=58325
BARTOS	17A	IJMP A32 1750154	E. Bartos <i>et al.</i>		REFID=58367
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58311
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM	16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57138
ACHASOV	16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57618
AULCHENKO	15	PR D91 052013	V.M. Aulchenko <i>et al.</i>	(SND Collab.)	REFID=56793
MATVIENKO	15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)	REFID=56601
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
ACHASOV	12	JETPL 94 734	M.N. Achasov <i>et al.</i>		REFID=54275

Translated from ZETFP 94 796.

LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=54121
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59494
DUBNICKA	10	APS 60 1	S. Dubnicka, A.Z. Dubnickova		REFID=58797
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=49614
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
ACHASOV	001	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47931
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=41355
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
DIEKMAN	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
ATKINSON	86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21508
ATKINSON	85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21506
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)	REFID=20136
ABE	84B	PRL 53 751	K. Abe <i>et al.</i>	(SLAC HFP Collab.)	REFID=21503
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
		Translated from ZETFP 37 613.			
ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21493
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)	REFID=21494
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)	REFID=21496
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21487
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)	REFID=21490
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)	REFID=21492
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21478
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)	REFID=21481
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)	REFID=21482
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)	REFID=21484
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)	REFID=21470
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parada	(GRAZ)	REFID=20126
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)	REFID=21661
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)	REFID=21465
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)	REFID=21450
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)	REFID=20610
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)	REFID=20637
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)	REFID=21449
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)	REFID=21434
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)	REFID=21435
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP	REFID=21426
JACOB	72	PR D5 1847	M. Jacob, R. Slansky		REFID=49668
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

$a_2(1700)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

NODE=M162

 $a_2(1700)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M162PP

NODE=M162PP

NODE=M162PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1630–1780) – i (60–250) OUR ESTIMATE			
$(1686 \pm 22^{+19}_{-7}) - i(211 \pm 38^{+32}_{-29})$	¹ KOPF	21	RVUE 0.9 $p\bar{p} \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$ and 191 $\pi^-p \rightarrow \pi^-\pi^-\pi^+p$
$(1638.9 \pm 2.3^{+57.4}_{-0.1}) - i(112.0 \pm 1.3^{+0.9}_{-24.2})$	² ALBRECHT	20	RVUE 0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
$(1722 \pm 15 \pm 67) - i(124 \pm 9 \pm 32)$	³ RODAS	19	RVUE 191 $\pi^-p \rightarrow \eta'\pi^-p$
$(1698 \pm 44) - i(133 \pm 28)$	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0\eta\eta$
¹ Based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.			
² Based on 2 poles, 2 channels ($\pi\eta, K\bar{K}$).			
³ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data.			

NODE=M162PP;LINKAGE=A

NODE=M162PP;LINKAGE=B

NODE=M162PP;LINKAGE=C

 $a_2(1700)$ MASS

NODE=M162M

NODE=M162M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1706 ± 14 OUR AVERAGE Error includes scale factor of 1.2.				
1681^{+22}_{-35}	46M	^{1,2} AGHASYAN	18B	COMP 190 $\pi^-p \rightarrow \pi^-\pi^+\pi^-p$
$1726 \pm 12 \pm 25$		² ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$
$1722 \pm 9 \pm 15$	18k	³ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
1660 ± 40		² ABELE	99B	CBAR 1.94 $\bar{p}p \rightarrow \pi^0\eta\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1720 \pm 10 \pm 60$		⁴ JACKURA	18	RVUE $\pi^-p \rightarrow \eta\pi^-p$
1675 ± 25		ANISOVICH	09	RVUE 0.0 $\bar{p}p, \pi N$
1702 ± 7	80k	⁵ UMAN	06	E835 5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
$1721 \pm 13 \pm 44$	145k	LU	05	B852 18 $\pi^-p \rightarrow \omega\pi^-\pi^0p$
$1737 \pm 5 \pm 7$		ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
1767 ± 14	221	⁶ ACCIARRI	01H	L3 $\gamma\gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
~ 1775		⁷ GRYGOREV	99	SPEC 40 $\pi^-p \rightarrow K_S^0 K_S^0 n$
$1752 \pm 21 \pm 4$		ACCIARRI	97T	L3 $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

¹ Statistical error negligible.² Breit-Wigner mass.³ From analysis of L3 data at 183–209 GeV.⁴ Superseded by RODAS 19.⁵ Statistical error only.⁶ Spin 2 dominant, isospin not determined, could also be $I=1$.⁷ Possibly two $J^P = 2^+$ resonances with isospins 0 and 1.

NODE=M162M;LINKAGE=B

NODE=M162M;LINKAGE=E

NODE=M162M;LINKAGE=SC

NODE=M162M;LINKAGE=D

NODE=M162M;LINKAGE=ST

NODE=M162M;LINKAGE=HA

NODE=M162M;LINKAGE=GR

 $a_2(1700)$ WIDTH

NODE=M162W

NODE=M162W

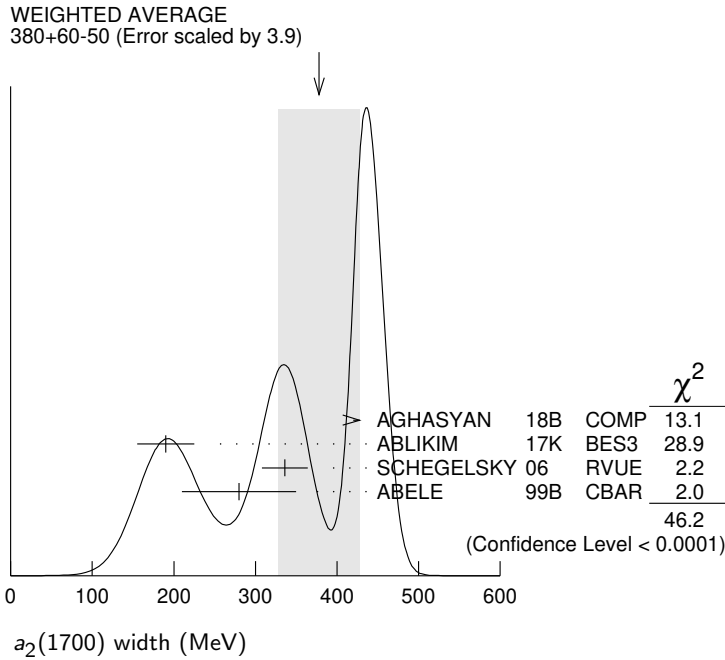
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
380⁺₋₅₀ OUR AVERAGE Error includes scale factor of 3.9. See the ideogram below.				
436^{+20}_{-16}	46M	^{1,2} AGHASYAN	18B	COMP 190 $\pi^-p \rightarrow \pi^-\pi^+\pi^-p$
$190 \pm 18 \pm 30$		² ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$
$336 \pm 20 \pm 20$	18k	³ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
280 ± 70		² ABELE	99B	CBAR 1.94 $\bar{p}p \rightarrow \pi^0\eta\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

280 ± 10 ± 70		⁴ JACKURA	18	RVUE	$\pi^- p \rightarrow \eta \pi^- p$
270 ⁺ ₋ 50 20		ANISOVICH	09	RVUE	0.0 $\bar{p} p, \pi N$
417 ± 19	80k	⁵ UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
279 ± 49 ± 66	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
151 ± 22 ± 24		ABE	04	BELL	10.6 $e^+ e^- \rightarrow$ $e^+ e^- K^+ K^-$
187 ± 60	221	⁶ ACCIARRI	01H	L3	$\gamma \gamma \rightarrow K_S^0 K_S^0, E_{cm}^{\text{see}} =$ 91, 183–209 GeV
150 ± 110 ± 34		ACCIARRI	97T	L3	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$

- ¹ Statistical error negligible.
- ² Breit-Wigner width.
- ³ From analysis of L3 data at 183–209 GeV.
- ⁴ Superseded by RODAS 19.
- ⁵ Statistical error only.
- ⁶ Spin 2 dominant, isospin not determined, could also be $I=1$.

NODE=M162W;LINKAGE=B
 NODE=M162W;LINKAGE=E
 NODE=M162W;LINKAGE=SC
 NODE=M162W;LINKAGE=D
 NODE=M162W;LINKAGE=ST
 NODE=M162W;LINKAGE=HA



$a_2(1700)$ DECAY MODES

NODE=M162215;NODE=M162

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta \pi$	(2.5 ± 0.6) %
Γ_2 $\eta' \pi$	seen
Γ_3 $\gamma \gamma$	(7.9 ± 1.7) × 10 ⁻⁷
Γ_4 $\rho \pi$	seen
Γ_5 $f_2(1270) \pi$	seen
Γ_6 $K \bar{K}$	(1.3 ± 0.8) %
Γ_7 $\omega \pi^- \pi^0$	seen
Γ_8 $\omega \rho$	seen

DESIG=4
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=1
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=5
 DESIG=6;OUR EVAL;→ UNCHECKED ←
 DESIG=7;OUR EVAL;→ UNCHECKED ←

$a_2(1700)$ PARTIAL WIDTHS

NODE=M162220

$\Gamma(\eta \pi)$

Γ_1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.5 ± 2.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$

NODE=M162W3
 NODE=M162W3

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W3;LINKAGE=SC

$\Gamma(\gamma\gamma)$ Γ_3

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.05	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M162W2
 NODE=M162W2

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W2;LINKAGE=SC

 $\Gamma(K\bar{K})$ Γ_6

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.0±3.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M162W1
 NODE=M162W1

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W1;LINKAGE=SC

 $a_2(1700) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M162225

$$\left[\Gamma(\rho\pi) + \Gamma(f_2(1270)\pi) \right] \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad (\Gamma_4 + \Gamma_5)\Gamma_3/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.29±0.04±0.02		ACCIARRI	97T L3	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$

NODE=M162G1
 NODE=M162G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.37^{+0.12}_{-0.08} \pm 0.10$	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
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¹ From analysis of L3 data at 183–209 GeV.

NODE=M162G1;LINKAGE=SC

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_3/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M162G2
 NODE=M162G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$20.6 \pm 4.2 \pm 4.6$	¹ ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
$49 \pm 11 \pm 13$	² ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$

¹ Assuming spin 2.

² Spin 2 dominant, isospin not determined, could also be $l=1$.

NODE=M162G2;LINKAGE=AB
 NODE=M162G;LINKAGE=HA

 $a_2(1700) \text{ BRANCHING RATIOS}$

NODE=M162235

 $\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$ Γ_4/Γ_5

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M162R01
 NODE=M162R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.4 \pm 0.4 \pm 0.1$	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
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¹ From analysis of L3 data at 183–209 GeV.

NODE=M162R01;LINKAGE=SC

 $\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_6/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M162R00
 NODE=M162R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.029 \pm 0.04^{+0.011}_{-0.012}$	¹ KOPF	21	RVUE	$0.9 p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^- \text{ and } 191 \pi^- p \rightarrow \pi^- \pi^- \pi^+ p$
$4.134 \pm 0.106^{+4.909}_{-2.988}$	² ALBRECHT	20	RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

NODE=M162R00;LINKAGE=B

² Residues from T-matrix pole, 2 poles, 2 channels ($\pi\eta, K\bar{K}$).

NODE=M162R00;LINKAGE=A

 $\Gamma(\eta'\pi)/\Gamma(\eta\pi)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M162R02
 NODE=M162R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.035 \pm 0.044^{+0.069}_{-0.012}$	¹ KOPF	21	RVUE	$0.9 p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^- \text{ and } 191 \pi^- p \rightarrow \pi^- \pi^- \pi^+ p$
-------------------------------------	-------------------	----	------	--

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

NODE=M162R02;LINKAGE=A

$a_2(1700)$ REFERENCES

KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
JACKURA	18	PL B779 464	A. Jackura <i>et al.</i>	(JPAC and COMPASS Collab.)
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
GRYGOREV	99	PAN 62 470	V.K. Grygorev <i>et al.</i>	
		Translated from YAF 62 513.		
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)

NODE=M162

REFID=61470
REFID=60439
REFID=59554
REFID=59471
REFID=59003
REFID=57953
REFID=56385
REFID=52719
REFID=51186
REFID=51185
REFID=51063
REFID=50459
REFID=49650
REFID=48580
REFID=48321
REFID=46904
REFID=46909
REFID=45761

$a_0(1710)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

OMITTED FROM SUMMARY TABLE

Evidence for this state is also inferred from the interference of the $K^+ K^-$ and $K_S^0 K_S^0$ decays of the $f_0(1710)$ in $D_s^+ \rightarrow f_0(1710)\pi^+$, leading to a relative branching ratio an order of magnitude larger than expected from isospin symmetry (ABLIKIM 22F). See also the review on "Spectroscopy of Light Meson Resonances."

NODE=M263

NODE=M263

$a_0(1710)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1713±19 OUR AVERAGE	Error includes scale factor of 3.8. See the ideogram below.		
1736±10±12	¹ AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
1817± 8±20	² ABLIKIM	22AH BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
1704± 5± 2	LEES	21A BABR	$\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$

NODE=M263M

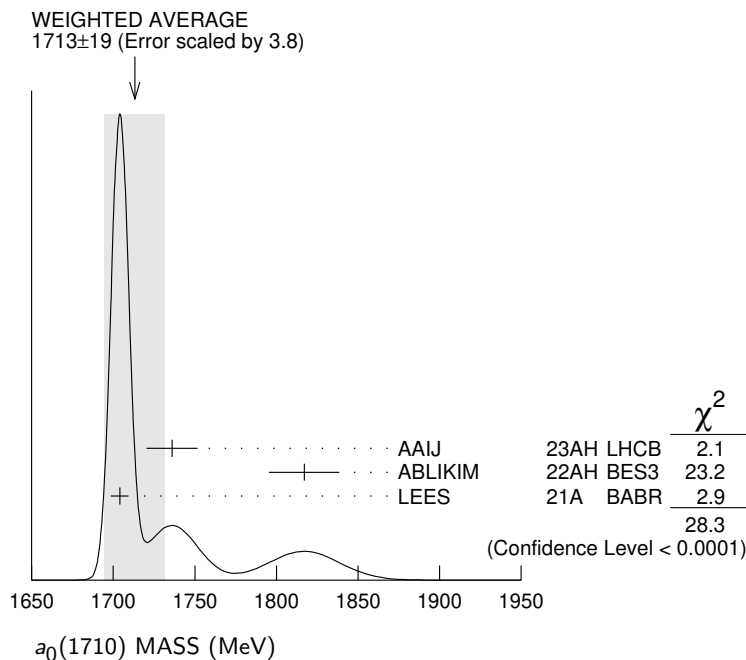
NODE=M263M

¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$

² Observed to decay into $K_S^0 K^+$ in a Breit-Wigner amplitude analysis involving D_s^+ decays into $\bar{K}^*(892)^0 K^+$, $\bar{K}^*(892)^+ K_S^0$, $\bar{K}^*(1410)^0 K^+$, $a_0(980)^+ \pi^0$, and $a_0(1817)^+ \pi^0$.

NODE=M263M;LINKAGE=B

NODE=M263M;LINKAGE=A



$a_0(1710)$ WIDTH

NODE=M263W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
107±15 OUR AVERAGE			
134±17±61	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
97±22±15	² ABLIKIM	22AH BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
110±15±11	LEES	21A BABR	$\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$
¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c.$			
² Observed to decay into $K_S^0 K^+$ in a Breit-Wigner amplitude analysis involving D_s^+ decays into $\bar{K}^*(892)^0 K^+$, $\bar{K}^*(892)^+ K_S^0$, $\bar{K}^*(1410)^0 K^+$, $a_0(980)^+ \pi^0$, and $a_0(1817)^+ \pi^0$.			

NODE=M263W

NODE=M263W;LINKAGE=B

NODE=M263W;LINKAGE=A

 $a_0(1710)$ DECAY MODES

NODE=M263215;NODE=M263

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi \eta$	seen
Γ_2 $K^+ K^-$	seen
Γ_3 $K_S^0 K_S^0$	seen
Γ_4 $K_S^0 K^+$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

 $a_0(1710)$ BRANCHING RATIOS

NODE=M263225

$\Gamma(\pi\eta)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
VALUE	LEES	21A	BABR	$\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$
seen				

NODE=M263R01

NODE=M263R01

$\Gamma(K^+ K^-)/\Gamma(K_S^0 K_S^0)$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_3
VALUE	¹ ABLIKIM	22F	BES3	$D_s^+ \rightarrow K_S^0 K_S^0 \pi^+$
0.32±0.12				

NODE=M263R00

NODE=M263R00

OCCUR=2

¹ Using $D_s^+ \rightarrow K^+ K^- \pi^+$ from ABLIKIM 21AE. The apparent violation of isospin symmetry may be due to a destructive interference with the $f_0(1710)$ in the $K^+ K^-$ channel, and a constructive interference in the $K_S^0 K_S^0$ channel.

NODE=M263R00;LINKAGE=B

$\Gamma(K_S^0 K^+)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
VALUE	ABLIKIM	22AH	BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
seen				

NODE=M263R02

NODE=M263R02

 $a_0(1710)$ REFERENCES

NODE=M263

AAIJ	23AH PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	22AH PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22F PR D105 L051103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AE PR D104 012016	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	21A PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)

REFID=62349

REFID=61880

REFID=61641

REFID=61367

REFID=61442

$f_0(1710)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M068

NODE=M068

NODE=M068PP

NODE=M068PP

NODE=M068PP

→ UNCHECKED ←

OCCUR=3

NODE=M068PP;LINKAGE=O

NODE=M068PP;LINKAGE=H

NODE=M068PP;LINKAGE=A

NODE=M068PP;LINKAGE=AV

 $f_0(1710)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1680–1820) – i (50–180) OUR ESTIMATE			
$(1769 \pm 8) - i(78 \pm 6)$	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
$(1700 \pm 18) - i(127 \pm 12)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1803 \pm 3.5^{+45.5}_{-10.4}) - i(145 \pm 2.5^{+16.3}_{-9.6})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
$(1732 \pm 15) - i(160^{+25}_{-10})$	³ ANISOVICH	03	RVUE $\pi\pi, K\bar{K}, \eta\eta, \eta\eta'$
$(1698 \pm 18) - i(60 \pm 13)$	BARBERIS	00E	OMEG 450 $pp \rightarrow p_f\eta\eta p_s$
$(1770 \pm 12) - i(110 \pm 20)$	⁴ ANISOVICH	99B	SPEC $0.6-1.2 p\bar{p} \rightarrow \eta\eta\pi^0$
$(1727 \pm 12 \pm 11) - i(63 \pm 8 \pm 9)$	BARBERIS	99D	OMEG 450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
$(1750 \pm 30) - i(125 \pm 70)$	ANISOVICH	98B	RVUE Compilation

¹T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).²T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).³Solution I.⁴Not seen by AMSLER 02. **$f_0(1710)$ Breit-Wigner MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1733^{+8}_{-7}		OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.
$1757 \pm 24 \pm 9$		LEES	21A	BABR $\eta_c(1S) \rightarrow \eta' K^+ K^-$
$1759 \pm 6^{+14}_{-25}$	5.5k	¹ ABLIKIM	13N	BES3 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
$1750^{+6}_{-7}^{+29}_{-18}$		² UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
$1701 \pm 5^{+9}_{-2}$	4k	³ CHEKANOV	08	ZEUS $e p \rightarrow K_S^0 K_S^0 X$
$1765^{+4}_{-3} \pm 13$		ABLIKIM	06V	BES2 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
1738 ± 30		ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
$1740 \pm 4^{+10}_{-25}$		BAI	03G	BES $J/\psi \rightarrow \gamma K\bar{K}$
1740^{+30}_{-25}		BAI	00A	BES $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
1710 ± 25		⁴ FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1744 \pm 7 \pm 5$	381	^{5,6} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
$1705 \pm 11 \pm 5$	237	^{5,6} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
$1706 \pm 4 \pm 5$	1.0k	^{5,6} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
$1690 \pm 8 \pm 3$	349	^{5,6} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
1750 ± 13		AMSLER	06	CBAR $1.64 \bar{p}p \rightarrow K^+ K^- \pi^0$
1747 ± 5	80k	⁷ UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
1776 ± 15		VLADIMIRSK...	06	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1670 ± 20		BINON	05	GAMS $33 \pi^- p \rightarrow \eta\eta n$
1682 ± 16		TIKHOMIROV	03	SPEC $40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1670 ± 26	3.6k	⁸ NICHITIU	02	OBLX $0 \bar{p}p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1730 ± 15		BARBERIS	99	OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$
1750 ± 20		BARBERIS	99B	OMEG 450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
1720 ± 39		BAI	98H	BES $J/\psi \rightarrow \gamma\pi^0\pi^0$
1775 ± 1.5	57	⁹ BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$
1690 ± 11		¹⁰ ABREU	96C	DLPH $Z^0 \rightarrow K^+ K^- + X$
$1696 \pm 5^{+9}_{-34}$		¹¹ BAI	96C	BES $J/\psi \rightarrow \gamma K^+ K^-$

NODE=M068M

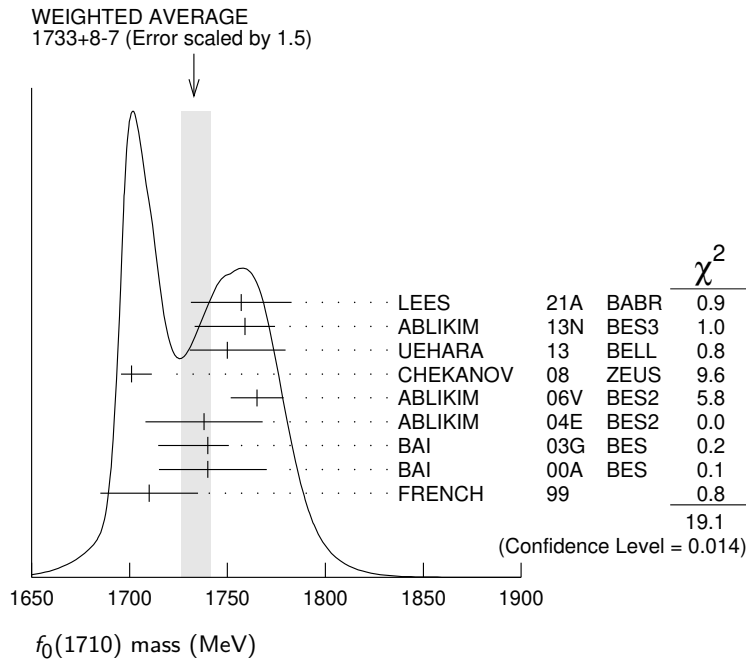
NODE=M068M

OCCUR=2

OCCUR=3

OCCUR=4

1781± 8	$^{+10}_{-31}$	BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2
1768±14		BALOSHIN	95	SPEC	$40 \pi^- C \rightarrow K_S^0 K_S^0 X$	
1750±15		¹² BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	
1620±16		¹¹ BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	OCCUR=2
1748±10		¹³ ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
~ 1750		BREAKSTONE	93	SFM	$p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$	
1744±15		¹⁴ ALDE	92D	GAM2	$38 \pi^- p \rightarrow \eta \eta n$	
1713±10		¹⁵ ARMSTRONG	89D	OMEG	$300 p p \rightarrow p p K^+ K^-$	
1706±10		¹⁵ ARMSTRONG	89D	OMEG	$300 p p \rightarrow p p K_S^0 K_S^0$	OCCUR=2
1707±10		¹³ AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$	
1700±15		¹¹ BOLONKIN	88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	
1720±60		BOLONKIN	88	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
1638±10		¹⁶ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
1690± 4		¹⁷ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
1698±15		¹³ AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$	
1720±10	± 10	¹¹ BALTRUSAIT..	87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$	
1755± 8		¹⁸ ALDE	86C	GAM2	$38 \pi^- p \rightarrow n 2\eta$	
1730 $^{+2}_{-10}$		¹⁹ LONGACRE	86	RVUE	$22 \pi^- p \rightarrow n 2K_S^0$	
1742±15		¹³ WILLIAMS	84	MPSF	$200 \pi^- N \rightarrow 2K_S^0 X$	
1670±50		BLOOM	83	CBAL	$J/\psi \rightarrow \gamma 2\eta$	
1650±50		BURKE	82	MRK2	$J/\psi \rightarrow \gamma 2\rho$	
1640±50		^{20,21} EDWARDS	82D	CBAL	$J/\psi \rightarrow \gamma 2\eta$	
1730±10	± 20	²² ETKIN	82C	MPS	$23 \pi^- p \rightarrow n 2K_S^0$	
		¹			From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.	NODE=M068M;LINKAGE=D
		²			Spin 0 favored over spin 2.	NODE=M068M;LINKAGE=H
		³			In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.	NODE=M068M;LINKAGE=HE
		⁴			$J^P = 0^+$, supersedes ARMSTRONG 89D.	NODE=M068M;LINKAGE=C3
		⁵			Using CLEO-c data but not authored by the CLEO Collaboration.	NODE=M068M;LINKAGE=F
		⁶			From a fit to a Breit-Wigner line shape with fixed $\Gamma = 135$ MeV.	NODE=M068M;LINKAGE=G
		⁷			Systematic errors not estimated.	NODE=M068M;LINKAGE=CH
		⁸			Decaying to $f_0(1370)\pi\pi$.	NODE=M068M;LINKAGE=NC
		⁹			No J^{PC} determination.	NODE=M068M;LINKAGE=4A
		¹⁰			No J^{PC} determination, width not determined.	NODE=M068M;LINKAGE=A4
		¹¹			$J^P = 2^+$.	NODE=M068M;LINKAGE=A3
		¹²			From a fit to the 0^+ partial wave.	NODE=M068M;LINKAGE=Q0
		¹³			No J^{PC} determination.	NODE=M068M;LINKAGE=A1
		¹⁴			ALDE 92D combines all the GAMS-2000 data.	NODE=M068M;LINKAGE=AA
		¹⁵			$J^P = 2^+$, superseded by FRENCH 99.	NODE=M068M;LINKAGE=C
		¹⁶			From an analysis ignoring interference with $f_2'(1525)$.	NODE=M068M;LINKAGE=A
		¹⁷			From an analysis including interference with $f_2'(1525)$.	NODE=M068M;LINKAGE=B
		¹⁸			Superseded by ALDE 92D.	NODE=M068M;LINKAGE=BB
		¹⁹			Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.	NODE=M068M;LINKAGE=A9
		²⁰			$J^P = 2^+$ preferred.	NODE=M068M;LINKAGE=B2
		²¹			From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.	NODE=M068M;LINKAGE=E
		²²			Superseded by LONGACRE 86.	NODE=M068M;LINKAGE=B1



$f_0(1710)$ Breit-Wigner WIDTH

NODE=M068W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
150 \pm 12 \pm 10		OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.
175 \pm 23 \pm 4		LEES	21A BABR	$\eta_c(1S) \rightarrow \eta' K^+ K^-$
172 \pm 10 $\begin{smallmatrix} +32 \\ -16 \end{smallmatrix}$	5.5k	1 ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
139 \pm 11 $\begin{smallmatrix} +96 \\ -50 \end{smallmatrix}$		2 UEHARA	13 BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
100 \pm 24 $\begin{smallmatrix} +7 \\ -22 \end{smallmatrix}$	4k	3 CHEKANOV	08 ZEUS	$e p \rightarrow K_S^0 K_S^0 X$
145 \pm 8 \pm 69		ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
125 \pm 20		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
166 \pm 5 $\begin{smallmatrix} +15 \\ -10 \end{smallmatrix}$		BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
120 \pm 50 $\begin{smallmatrix} +50 \\ -40 \end{smallmatrix}$		BAI	00A BES	$J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
105 \pm 34		4 FRENCH	99	300 $p p \rightarrow p_f (K^+ K^-) p_S$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
148 \pm 40 $\begin{smallmatrix} +40 \\ -30 \end{smallmatrix}$		AMSLER	06 CBAR	1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
188 \pm 13	80k	5 UMAN	06 E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
250 \pm 30		VLADIMIRSK..06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
260 \pm 50		BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
102 \pm 26		TIKHOMIROV	03 SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
267 \pm 44	3651	6 NICHITIU	02 OBLX	0 $\bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
100 \pm 25		BARBERIS	99 OMEG	450 $p p \rightarrow p_S p_f K^+ K^-$
160 \pm 30		BARBERIS	99B OMEG	450 $p p \rightarrow p_S p_f \pi^+ \pi^-$
30 \pm 7	57	7 BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$
103 \pm 18 $\begin{smallmatrix} +30 \\ -11 \end{smallmatrix}$		8 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
85 \pm 24 $\begin{smallmatrix} +22 \\ -19 \end{smallmatrix}$		BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
56 \pm 19		BALOSHIN	95 SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
160 \pm 40		9 BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
160 \pm 60 $\begin{smallmatrix} +60 \\ -20 \end{smallmatrix}$		8 BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
264 \pm 25		10 ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
200 to 300		BREAKSTONE	93 SFM	$p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$
< 80 90% CL		11 ALDE	92D GAM2	38 $\pi^- p \rightarrow \eta \eta N^*$
181 \pm 30		12 ARMSTRONG	89D OMEG	300 $p p \rightarrow p p K^+ K^-$

NODE=M068W

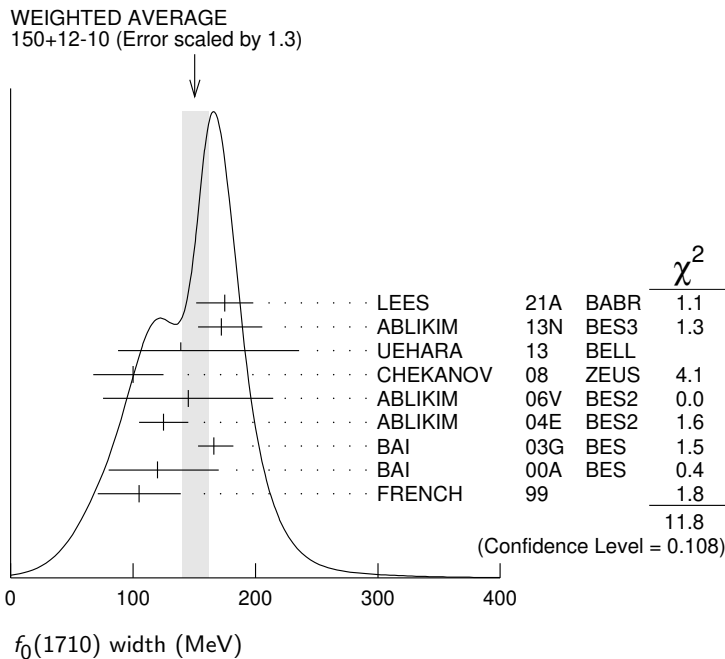
OCCUR=2

OCCUR=2

104 ± 30	12 ARMSTRONG 89D OMEG	300 pp → ppK _S ⁰ K _S ⁰	OCCUR=2
166.4 ± 33.2	10 AUGUSTIN 88 DM2	J/ψ → γK ⁺ K ⁻ , K _S ⁰ K _S ⁰	
30 ± 20	8 BOLONKIN 88 SPEC	40 π ⁻ p → K _S ⁰ K _S ⁰ n	
350 ± 150	BOLONKIN 88 SPEC	40 π ⁻ p → K _S ⁰ K _S ⁰ n	OCCUR=2
148 ± 17	13 FALVARD 88 DM2	J/ψ → φK ⁺ K ⁻ , K _S ⁰ K _S ⁰	
184 ± 6	14 FALVARD 88 DM2	J/ψ → φK ⁺ K ⁻ , K _S ⁰ K _S ⁰	OCCUR=2
136 ± 28	10 AUGUSTIN 87 DM2	J/ψ → γπ ⁺ π ⁻	
130 ± 20	8 BALTRUSAIT..87 MRK3	J/ψ → γK ⁺ K ⁻	
122 + 74 - 15	15 LONGACRE 86 RVUE	22 π ⁻ p → n2K _S ⁰	
57 ± 38	16 WILLIAMS 84 MPSF	200 π ⁻ N → 2K _S ⁰ X	
160 ± 80	BLOOM 83 CBAL	J/ψ → γ2η	
200 ± 100	BURKE 82 MRK2	J/ψ → γ2ρ	
220 + 100 - 70	17,18 EDWARDS 82D CBAL	J/ψ → γ2η	
200 + 156 - 9	19 ETKIN 82B MPS	23 π ⁻ p → n2K _S ⁰	

- 1 From partial wave analysis including all possible combinations of 0⁺⁺, 2⁺⁺, and 4⁺⁺ resonances.
- 2 Spin 0 favored over spin 2.
- 3 In the SU(3) based model with a specific interference pattern of the f₂(1270), a₂⁰(1320), and f₂'(1525) mesons incoherently added to the f₀(1710) and non-resonant background.
- 4 J^P = 0⁺, supersedes ARMSTRONG 89D.
- 5 Systematic errors not estimated.
- 6 Decaying to f₀(1370)ππ.
- 7 No J^{PC} determination.
- 8 J^P = 2⁺.
- 9 From a fit to the 0⁺ partial wave.
- 10 No J^{PC} determination.
- 11 ALDE 92D combines all the GAMS-2000 data.
- 12 J^P = 2⁺, (0⁺ excluded).
- 13 From an analysis ignoring interference with f₂'(1525).
- 14 From an analysis including interference with f₂'(1525).
- 15 Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.
- 16 No J^{PC} determination.
- 17 J^P = 2⁺ preferred.
- 18 From fit neglecting nearby f₂'(1525). Replaced by BLOOM 83.
- 19 From an amplitude analysis of the K_S⁰K_S⁰ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=F
 NODE=M068W;LINKAGE=G
 NODE=M068W;LINKAGE=HE
 NODE=M068W;LINKAGE=C3
 NODE=M068W;LINKAGE=CH
 NODE=M068W;LINKAGE=NC
 NODE=M068W;LINKAGE=4A
 NODE=M068W;LINKAGE=A3
 NODE=M068W;LINKAGE=Q0
 NODE=M068W;LINKAGE=A1
 NODE=M068W;LINKAGE=AA
 NODE=M068W;LINKAGE=B
 NODE=M068W;LINKAGE=C
 NODE=M068W;LINKAGE=D
 NODE=M068W;LINKAGE=A9
 NODE=M068M;LINKAGE=WI
 NODE=M068W;LINKAGE=B2
 NODE=M068W;LINKAGE=E
 NODE=M068W;LINKAGE=A



$f_0(1710)$ DECAY MODES

NODE=M068215;NODE=M068

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	seen
Γ_2 $\eta\eta$	seen
Γ_3 $\eta\eta'$	not seen
Γ_4 $\pi\pi$	seen
Γ_5 $\gamma\gamma$	seen
Γ_6 $\omega\omega$	seen

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=4

 $f_0(1710)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M068220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	

NODE=M068G2
NODE=M068G2

$12^{+3}_{-2} + 227^{+2}_{-8}$ UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<480	95	ALBRECHT	90G	ARG	$\gamma\gamma \rightarrow K^+ K^-$
<110	95	¹ BEHREND	89C	CELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
<280	95	¹ ALTHOFF	85B	TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ Assuming helicity 2.

NODE=M068G2;LINKAGE=F

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_5/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	

NODE=M068G3
NODE=M068G3

<0.82 95 ¹ BARATE 00E ALEP $\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ Assuming spin 0.

NODE=M068G;LINKAGE=Z

 $f_0(1710)$ BRANCHING RATIOS

NODE=M068225

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	

NODE=M068R2
NODE=M068R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	1004	¹ DOBBS	15		$J/\psi \rightarrow \gamma K^+ K^-$
seen	349	¹ DOBBS	15		$\psi(2S) \rightarrow \gamma K^+ K^-$
0.36 ± 0.12		ALBALADEJO	08	RVUE	
$0.38^{+0.09}_{-0.19}$		² LONGACRE	86	MPS	$22 \pi^- p \rightarrow n 2K_S^0$

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R2;LINKAGE=A
NODE=M068R;LINKAGE=L

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE		DOCUMENT ID	TECN		

NODE=M068R1
NODE=M068R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.22 ± 0.12		ALBALADEJO	08	RVUE	
$0.18^{+0.03}_{-0.13}$		¹ LONGACRE	86	RVUE	

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R1;LINKAGE=L

$\Gamma(\eta\eta)/\Gamma(K\bar{K})$					Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	

NODE=M068R7
NODE=M068R7

0.48 ± 0.15 BARBERIS 00E 450 $p\bar{p} \rightarrow p_f \eta \eta p_S$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.46^{+0.70}_{-0.38}$		¹ ANISOVICH	02D	SPEC	Combined fit
<0.02	90	² PROKOSHKIN	91	GA24	$300 \pi^- p \rightarrow \pi^- p \eta \eta$

¹ From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M068R7;LINKAGE=CH

² Combining results of GAM4 with those of ARMSTRONG 89D.

NODE=M068R;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • •				We do not use the following data for averages, fits, limits, etc. • • •
seen	381	¹ DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
seen	237	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
not seen		AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
$0.039^{+0.002}_{-0.024}$		² LONGACRE	86	RVUE

NODE=M068R5
 NODE=M068R5

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M068R5;LINKAGE=A
 NODE=M068R5;LINKAGE=L

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity. $\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.23±0.05 OUR AVERAGE				Error includes scale factor of 1.2.
$0.64 \pm 0.27 \pm 0.18$		LEES	18A	BABR $\Upsilon(1S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
$0.41^{+0.11}_{-0.17}$		ABLIKIM	06V	BES2 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
$0.2 \pm 0.024 \pm 0.036$		BARBERIS	99D	OMEG 450 $pp \rightarrow K^+K^-, \pi^+\pi^-$
0.39 ± 0.14		ARMSTRONG	91	OMEG 300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$
• • •				We do not use the following data for averages, fits, limits, etc. • • •
0.32 ± 0.14		ALBALADEJO	08	RVUE
< 0.11	95	¹ ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+K^-$
$5.8^{+9.1}_{-5.5}$		² ANISOVICH	02D	SPEC Combined fit

NODE=M068R6
 NODE=M068R6

¹ Using data from ABLIKIM 04A.

NODE=M068R;LINKAGE=AB
 NODE=M068R;LINKAGE=CH

² From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data. $\Gamma(\eta\eta')/\Gamma(\pi\pi)$ Γ_3/Γ_4

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.87 \times 10^{-3}$	90	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$

NODE=M068R00
 NODE=M068R00

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave.

NODE=M068R00;LINKAGE=A

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	180	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$

NODE=M068R3
 NODE=M068R3

 $f_0(1710)$ REFERENCES

NODE=M068

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also		PR D107 079901 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61442
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
LEES	18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58950
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ALBALADEJO	08	PRL 101 252002	M. Albaladejo, J.A. Oller		REFID=52656
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
Translated from YAF 69 515.					
Translated from YAF 68 998.					
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
Translated from YAF 66 860.					
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
Translated from YAF 65 1583.					

NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47426
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47428
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>		REFID=46886
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
FRENCH	99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)	REFID=47491
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BARKOV	98	JETPL 68 764	B.P. Barkov <i>et al.</i>		REFID=46616
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)	REFID=44621
		Translated from YAF 58 50.			
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BREAKSTONE	93	ZPHY C58 251	A.M. Breakstone <i>et al.</i>	(IOWA, CERN, DORT+)	REFID=43312
ALDE	92D	PL B284 457	D.M. Alde <i>et al.</i>	(GAM2 Collab.)	REFID=41591
	Also	SJNP 54 451	D.M. Alde <i>et al.</i>	(GAM2 Collab.)	REFID=44696
		Translated from YAF 54 745.			
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41010
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86C	PL B182 105	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=21694
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=21418
WILLIAMS	84	PR D30 877	E.G.H. Williams <i>et al.</i>	(VAND, NDAM, TUFTS+)	REFID=21693
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ETKIN	82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20391
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355

NODE=M255

X(1750)

$$I^G(J^{PC}) = ?-(1^{--})$$

OMITTED FROM SUMMARY TABLE

The X(1750) was separated from the $\phi(1680)$ in the 2022 listings due to its incompatible mass and incompatible pattern of $\bar{K}K$ and $\bar{K}^*(892)K$ branching fractions.

NODE=M255

X(1750) MASS

NODE=M255M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1753.8 ± 2.7 OUR AVERAGE			
1784 ± 12 ⁺⁰ / ₋₂₇	ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1753.5 ± 1.5 ± 2.3	LINK	02K FOCUS	20-160 $\gamma p \rightarrow K^+ K^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1726 ± 22	BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
1760 ± 20	ATKINSON	85C OMEG	20-70 $\gamma p \rightarrow \bar{K} \bar{K} X$
1690 ± 10	ASTON	81F OMEG	25-70 $\gamma p \rightarrow K^+ K^- X$

NODE=M255M

X(1750) WIDTH

NODE=M255W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
120 ± 10 OUR AVERAGE			
106 ⁺²² / ₋₁₉ ⁺⁸ / ₋₃₆	ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
122.2 ± 6.2 ± 8.0	LINK	02K FOCUS	20-160 $\gamma p \rightarrow K^+ K^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
121 ± 47	BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
80 ± 40	ATKINSON	85C OMEG	20-70 $\gamma p \rightarrow \bar{K} \bar{K} X$
100 ± 40	ASTON	81F OMEG	25-70 $\gamma p \rightarrow K^+ K^- X$

NODE=M255W

X(1750) DECAY MODES

NODE=M255215;NODE=M255

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^+ K^-$	seen
Γ_2 $\bar{K}^*(892)^0 K_S^0$	not seen
Γ_3 $K^*(892)^\pm K^\mp$	not seen
Γ_4 $\eta\phi$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4

X(1750) BRANCHING RATIOS

NODE=M255225

$\Gamma(\bar{K}^*(892)^0 K_S^0)/\Gamma(K^+ K^-)$		Γ_2/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN COMMENT
<0.065	90	LINK	02K FOCS $\gamma p \rightarrow K^+ K^- p$

NODE=M255R01
NODE=M255R01

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma(K^+ K^-)$		Γ_3/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN COMMENT
<0.183	90	LINK	02K FOCS $\gamma p \rightarrow K^+ K^- p$

NODE=M255R02
NODE=M255R02

$\Gamma(\eta\phi)/\Gamma_{\text{total}}$		Γ_4/Γ	
VALUE	CL%	DOCUMENT ID	TECN COMMENT
not seen		¹ ZHU	23A RVUE $e^+ e^- \rightarrow \eta\phi$

NODE=M255R00
NODE=M255R00

¹ Reported with a 2 σ significance in the fit and an upper limit of $\Gamma(e^+ e^-) B(X(1750) \rightarrow \eta\phi)$ in the range 136–322 eV.

NODE=M255R00;LINKAGE=A

X(1750) REFERENCES

NODE=M255

ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BUSENITZ	89	PR D40 1	J.K. Busenitz <i>et al.</i>	(ILL, FNAL)
ATKINSON	85C	ZPHY C27 233	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)

REFID=62439
REFID=60256
REFID=48845
REFID=40927
REFID=21596
REFID=21585

NODE=M114

 $\eta(1760)$

$$J^{PC} = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Seen by DM2 in the $\rho\rho$ system (BISELLO 89B). Structure in this region has been reported before in the same system (BALTRUSAITIS 86B) and in the $\omega\omega$ system (BALTRUSAITIS 85C, BISELLO 87).

NODE=M114

 $\eta(1760)$ MASS

NODE=M114M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1751 ± 15 OUR AVERAGE				
$1768^{+24}_{-25} \pm 10$	465	¹ ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
$1744 \pm 10 \pm 15$	1045	² ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1703^{+12}_{-11} \pm 2$		³ ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
1760 ± 11	320	⁴ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114M

OCCUR=2

¹ From a single-resonance fit.² From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.³ From a two-resonance fit.⁴ Estimated by us from various fits. Systematic uncertainties not estimated.

NODE=M114M;LINKAGE=ZA
NODE=M114M;LINKAGE=MA
NODE=M114M;LINKAGE=ZH
NODE=M114M;LINKAGE=A

 $\eta(1760)$ WIDTH

NODE=M114W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
240 ± 30 OUR AVERAGE				
$224^{+62}_{-56} \pm 25$	465	⁵ ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
$244^{+24}_{-21} \pm 25$	1045	⁶ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$42^{+36}_{-22} \pm 15$		⁷ ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
60 ± 16	320	⁸ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114W

OCCUR=2

⁵ From a single-resonance fit.

⁶ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.

⁷ From a two-resonance fit.

⁸ Estimated by us from various fits. Systematic uncertainties not estimated.

NODE=M114W;LINKAGE=ZA

NODE=M114W;LINKAGE=MA

NODE=M114W;LINKAGE=ZH

NODE=M114W;LINKAGE=B

$\eta(1760)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2\pi^+2\pi^-$	seen
Γ_3 $\pi^+\pi^-2\pi^0$	seen
Γ_4 $\rho^0\rho^0$	seen
Γ_5 $\rho^+\rho^-$	seen
Γ_6 $\omega\omega$	seen
Γ_7 $\eta'\pi^+\pi^-$	seen
Γ_8 $\gamma\gamma$	seen

NODE=M114215;NODE=M114

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=7

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

$\eta(1760)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_8/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
$28.2^{+7.9}_{-7.5} \pm 3.7$	465	⁹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3.0^{+2.0}_{-1.2} \pm 0.8$	52	¹⁰ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
$18^{+13}_{-10} \pm 5$	315	¹¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

NODE=M114225

NODE=M114G01

NODE=M114G01

OCCUR=2

OCCUR=3

⁹ From a single-resonance fit.

¹⁰ From a two-resonance fit. For constructive interference with the $X(1835)$.

¹¹ From a two-resonance fit. For destructive interference with the $X(1835)$.

NODE=M114G01;LINKAGE=ZH

NODE=M114G01;LINKAGE=ZA

NODE=M114G01;LINKAGE=ZN

$\eta(1760)$ BRANCHING RATIOS

$\Gamma(2\pi^+2\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma 2\pi^+2\pi^-$

NODE=M114R01

NODE=M114R01

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \pi^+\pi^-2\pi^0$

NODE=M114R02

NODE=M114R02

$\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^0\rho^0$
seen	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma \rho^0\rho^0$

NODE=M114R03

NODE=M114R03

$\Gamma(\rho^+\rho^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	89B DM2	$J/\psi \rightarrow \gamma \rho^+\rho^-$
seen	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma \rho^+\rho^-$

NODE=M114R04

NODE=M114R04

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BISELLO	87 DM2	$J/\psi \rightarrow \omega\omega$
seen	BALTRUSAIT..85C	MRK3	$J/\psi \rightarrow \gamma\omega\omega$

NODE=M114R06

NODE=M114R06

$\Gamma(\gamma\gamma)/\Gamma(\omega\omega)$ Γ_8/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.48 \times 10^{-3}$	90	¹² ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M114R08

NODE=M114R08

¹² Using results from ABLIKIM 06H.

NODE=M114R08;LINKAGE=A

$\eta(1760)$ REFERENCES

ABLIKIM 180 PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHANG 12A PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06H PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)
BISELLO 89B PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
BISELLO 87 PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BALTRUSAIT... 86 PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BALTRUSAIT... 86B PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BALTRUSAIT... 85C PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)

NODE=M114

REFID=58925
REFID=54763
REFID=51125
REFID=40575
REFID=40012
REFID=22009
REFID=22100
REFID=22095

$f_0(1770)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M264

NODE=M264

$f_0(1770)$ Breit-Wigner MASS

NODE=M264M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1804 ± 16 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
[1784 ⁺¹⁶ ₋₁₄ MeV OUR 2024 AVERAGE		Scale factor = 1.1]		

NODE=M264M
NEW

1834 ± 14 ⁺² ₋₁₀		DOROFEEV 24	VES	29 $\pi^- \text{Be} \rightarrow A\omega\phi$
1814 ± 31	7.2k	¹ KHOLODENK..21	VES	29 $\pi^- p \rightarrow n\omega\phi$
1795 ± 7 ⁺²³ ₋₂₀		ABLIKIM 13J	BES3	$J/\psi \rightarrow \gamma\omega\phi$
1760 ± 15 ⁺¹⁵ ₋₁₀		ABLIKIM 05Q	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1765 ± 15		SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
1814 ± 18	2,3	AAIJ 14BR	LHCB	$\bar{B}_s^0 \rightarrow J/\psi\pi^+\pi^-$
1812 ⁺¹⁹ ₋₂₆ ± 18		⁴ ABLIKIM 06J	BES2	$J/\psi \rightarrow \gamma\omega\phi$
1790 ⁺⁴⁰ ₋₃₀		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$

¹ From partial wave analysis of $\omega\phi$ invariant mass including 0^{++} , 2^{++} , and 0^{-+} resonances.

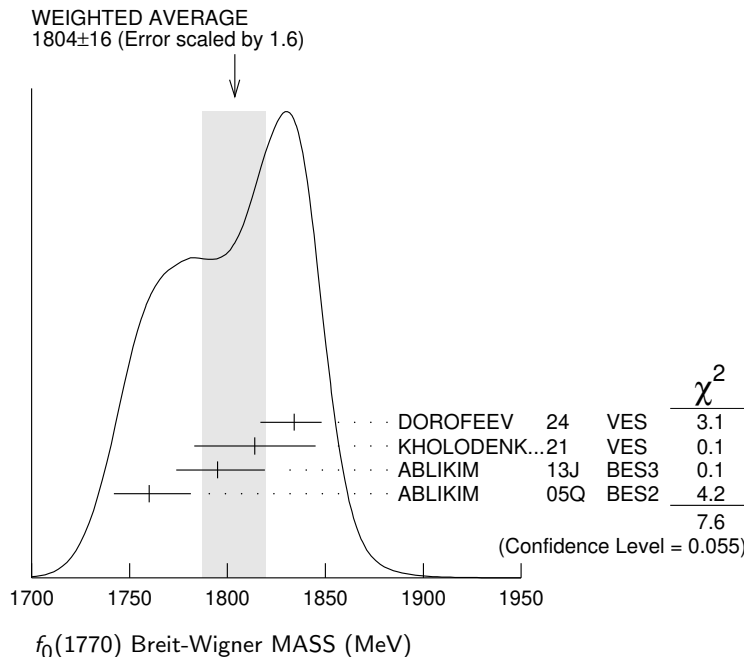
² Second solution: 1800 ± 22 MeV. The fit favors $f_0(1770)$ to $f_0(1710)$.

³ Statistical error only.

⁴ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm\omega\phi$.

NODE=M264M;LINKAGE=M

NODE=M264M;LINKAGE=A
NODE=M264M;LINKAGE=B
NODE=M264M;LINKAGE=L



$f_0(1770)$ Breit-Wigner WIDTH

NODE=M264W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

138⁺²²₋₂₅ OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.
 [161 ± 21 MeV OUR 2024 AVERAGE Scale factor = 1.4]

114 ± 15 ⁺⁵ ₋₁₅		DOROFEEV	24	VES	29 π ⁻ Be → Aωφ
182 ± 19	7.2k	¹ KHOLODENK..21		VES	29 π ⁻ p → nωφ
95 ± 10 ⁺⁷⁸ ₋₈₂		ABLIKIM	13J	BES3	J/ψ → γωφ
125 ± 25 ⁺¹⁰ ₋₁₅		ABLIKIM	05Q	BES2	ψ(2S) → γπ ⁺ π ⁻ K ⁺ K ⁻
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
180 ± 20		SARANTSEV	21	RVUE	J/ψ → γ (ππ, K ⁻ K ⁺ , ηη, ωφ)
328 ± 34		^{2,3} AAIJ	14BR	LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$
105 ± 20 ± 28		⁴ ABLIKIM	06J	BES2	J/ψ → γωφ
270 ⁺⁶⁰ ₋₃₀		⁵ ABLIKIM	05	BES2	J/ψ → φπ ⁺ π ⁻

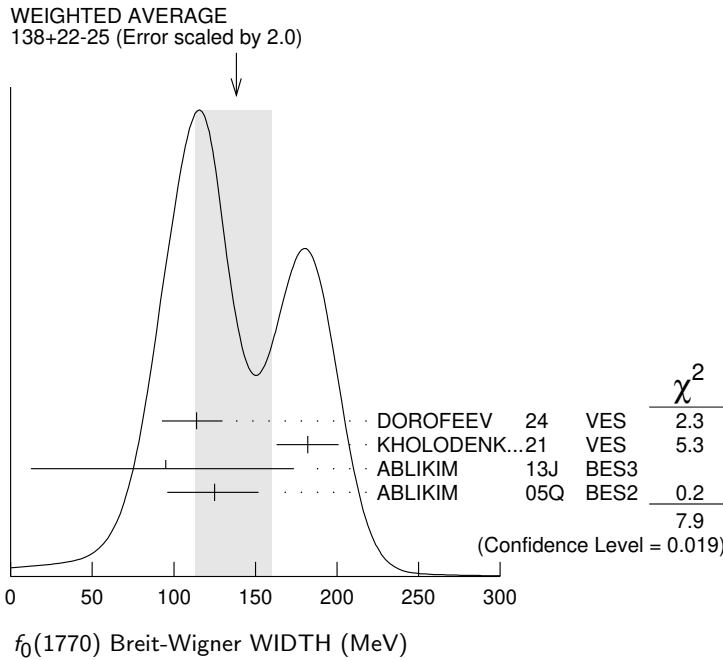
- ¹ From partial wave analysis of ωφ invariant mass including 0⁺⁺, 2⁺⁺, and 0⁻⁺ resonances.
- ² Second solution: 263 ± 30 MeV. The fit favors f₀(1770) to f₀(1710).
- ³ Statistical error only.
- ⁴ Not seen by LIU 09 in B[±] → K[±]ωφ.
- ⁵ f₀(1710) width fixed to PDG value.

NODE=M264W

NEW

NODE=M264W;LINKAGE=J

NODE=M264W;LINKAGE=A
 NODE=M264W;LINKAGE=B
 NODE=M264W;LINKAGE=I
 NODE=M264W;LINKAGE=AB



f₀(1770) DECAY MODES

NODE=M264215;NODE=M264

Mode	Fraction (Γ _i /Γ)
Γ ₁ ππ	seen
Γ ₂ K ⁻ K ⁺	seen
Γ ₃ ηη	seen
Γ ₄ ωφ	seen

DESIG=1
 DESIG=2
 DESIG=3
 DESIG=4

f₀(1770) BRANCHING RATIOS

NODE=M264225

VALUE	DOCUMENT ID	TECN	COMMENT	Γ ₁ /Γ
seen	SARANTSEV	21	RVUE	J/ψ → γ (ππ, K ⁻ K ⁺ , ηη, ωφ)
seen	AAIJ	14BR	LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$
seen	ABLIKIM	05	BES2	J/ψ → φπ ⁺ π ⁻

NODE=M264R01
 NODE=M264R01

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$	

NODE=M264R02
NODE=M264R02 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen	SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$	

NODE=M264R03
NODE=M264R03 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
seen	7.2k	KHOLODENK..21	VES	$29 \pi^- p \rightarrow n\omega\phi$	
seen		SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$	

NODE=M264R04
NODE=M264R04 $\Gamma(\pi\pi)/\Gamma_{\text{total}} \times \Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT	$\Gamma_1/\Gamma \times \Gamma_4/\Gamma$
--------------------------	-------------	------	---------	--

NODE=M264R00
NODE=M264R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.8 ± 1.2 ¹ DOROFEEV 24 VES 29 $\pi^- \text{Be} \rightarrow A\omega\phi$ ¹ Using one-pion exchange. Assigning this resonance to be $f_0(1710)$ instead gives $B(f_0 \rightarrow \pi\pi) \times B(f_0 \rightarrow \omega\phi) = (3.9 \pm 1.0) \times 10^{-3}$.

NODE=M264R00;LINKAGE=A

 $f_0(1770)$ REFERENCES

DOROFEEV 24	EPJ A60 105	V.A. Dorofeev <i>et al.</i>	(VES Collab.)	REFID=62700
KHOLODENK...21	PAN 83 1602	M.S. Kholodenko	(VES Collab.)	REFID=61410
SARANTSEV 21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
AAIJ 14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56035
ABLIKIM 13J	PR D87 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54955
LIU 09	PR D79 071102	C. Liu <i>et al.</i>	(BELLE Collab.)	REFID=52752
ABLIKIM 06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM 05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM 05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958

NODE=M264

 $\pi(1800)$

$$I^G(J^{PC}) = 1^-(0^-+)$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M075

NODE=M075

 $\pi(1800)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M075M

NODE=M075M

1810⁺⁹₋₁₁ OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

1804 ⁺⁶ ₋₉	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1876 ± 18 ± 16	4k	² EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$
1774 ± 18 ± 20		³ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1863 ± 9 ± 10		⁴ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1840 ± 10 ± 10	1.2k	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
1775 ± 7 ± 10		⁵ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1790 ± 14		⁶ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1873 ± 33 ± 20		BELADIDZE	92C	VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
1814 ± 10 ± 23	426	BITYUKOV	91	VES	36 $\pi^- C \rightarrow \pi^- \eta \eta C$
1770 ± 30	1.1k	BELLINI	82	SPEC	40 $\pi^- A \rightarrow 3\pi A$

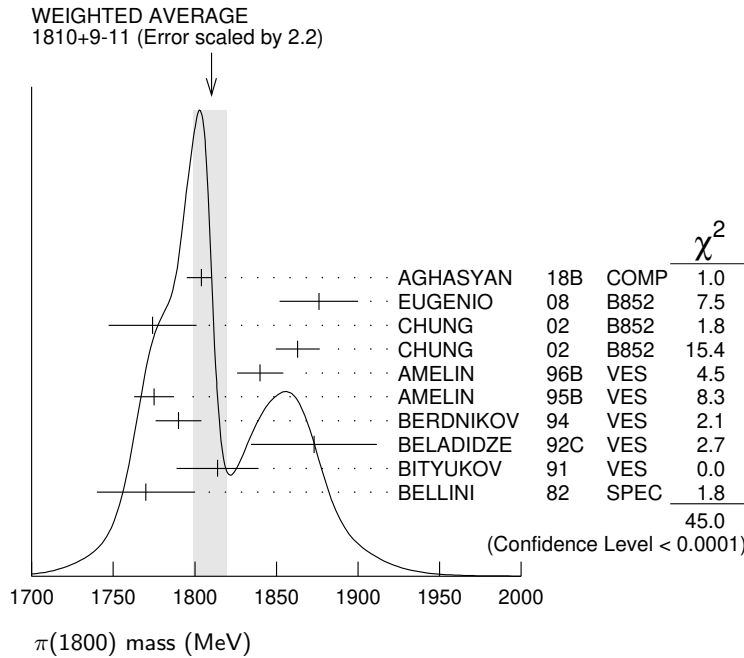
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1785 ± 9 ⁺¹² ₋₆	420k	⁷ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1737 ± 5 ± 15		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

- 1 Statistical error negligible.
- 2 From a single-pole fit.
- 3 In the $f_0(980)\pi$ wave.
- 4 In the $f_0(500)\pi$ wave.
- 5 From a fit to $J^{PC} = 0^{-+} f_0(980)\pi, f_0(1370)\pi$ waves.
- 6 From a fit to $J^{PC} = 0^{-+} K_0^*(1430)K^-, f_0(980)\pi^-$ waves.
- 7 Superseded by AGHASYAN 2018B.

NODE=M075M;LINKAGE=B
 NODE=M075M;LINKAGE=SP
 NODE=M075M;LINKAGE=C1
 NODE=M075M;LINKAGE=C2
 NODE=M075M;LINKAGE=AX
 NODE=M075M;LINKAGE=A
 NODE=M075M;LINKAGE=C



$\pi(1800)$ WIDTH

NODE=M075W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
215⁺⁷₋₈ OUR AVERAGE					
220 ⁺⁸ ₋₁₁	46M	8 AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
221 ^{±26} ±38	4k	9 EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$
223 ^{±48} ±50		10 CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
191 ^{±21} ±20		11 CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
210 ^{±30} ±30	1.2k	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta\eta\pi^- A$
190 ^{±15} ±15		12 AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
210 ^{±70}		13 BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
225 ^{±35} ±20		BELADIDZE	92C	VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
205 ^{±18} ±32	426	BITYUKOV	91	VES	36 $\pi^- C \rightarrow \pi^- \eta\eta C$
310 ^{±50}	1.1k	BELLINI	82	SPEC	40 $\pi^- A \rightarrow 3\pi A$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
208 ^{±22} ⁺²¹ ₋₃₇	420k	14 ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
259 ^{±19} ±6		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M075W

OCCUR=2

- 8 Statistical error negligible.
- 9 From a single-pole fit.
- 10 In the $f_0(980)\pi$ wave.
- 11 In the $f_0(500)\pi$ wave.
- 12 From a fit to $J^{PC} = 0^{-+} f_0(980)\pi, f_0(1370)\pi$ waves.
- 13 From a fit to $J^{PC} = 0^{-+} K_0^*(1430)K^-, f_0(980)\pi^-$ waves.
- 14 Superseded by AGHASYAN 2018B.

NODE=M075W;LINKAGE=B
 NODE=M075W;LINKAGE=SP
 NODE=M075W;LINKAGE=C1
 NODE=M075W;LINKAGE=C2
 NODE=M075W;LINKAGE=AX
 NODE=M075W;LINKAGE=A
 NODE=M075W;LINKAGE=C

$\pi(1800)$ DECAY MODES

NODE=M075215;NODE=M075

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\pi^-\pi^-$	seen
Γ_2 $f_0(500)\pi^-$	seen
Γ_3 $f_0(980)\pi^-$	seen
Γ_4 $f_0(1370)\pi^-$	seen
Γ_5 $f_0(1500)\pi^-$	not seen
Γ_6 $\rho\pi^-$	not seen
Γ_7 $\eta\eta\pi^-$	seen
Γ_8 $a_0(980)\eta$	seen
Γ_9 $a_2(1320)\eta$	not seen
Γ_{10} $f_2(1270)\pi$	not seen
Γ_{11} $f_0(1370)\pi^-$	not seen
Γ_{12} $f_0(1500)\pi^-$	seen
Γ_{13} $\eta\eta'(958)\pi^-$	seen
Γ_{14} $K_0^*(1430)K^-$	seen
Γ_{15} $K^*(892)K^-$	not seen

DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=12
DESIG=2
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=13
DESIG=14
DESIG=15
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=4
DESIG=9

 $\pi(1800)$ BRANCHING RATIOS

NODE=M075220

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$					Γ_3/Γ_2
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
$0.44 \pm 0.08 \pm 0.38$	15 CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+\pi^-\pi^- p$	

NODE=M075R11
NODE=M075R11

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$					Γ_3/Γ_4
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
1.7 ± 1.3	16 AMELIN	95B	VES	$36 \pi^- A \rightarrow \pi^+\pi^-\pi^- A$	

NODE=M075R5
NODE=M075R5

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	BELLINI	82	SPEC	$40 \pi^- A \rightarrow 3\pi A$	

NODE=M075R1
NODE=M075R1

$\Gamma(f_0(1500)\pi^-)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+\pi^-\pi^- p$	

NODE=M075R12
NODE=M075R12

$\Gamma(\rho\pi^-)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	BELLINI	82	SPEC	$40 \pi^- A \rightarrow 3\pi A$	

NODE=M075R2
NODE=M075R2

$\Gamma(\rho\pi^-)/\Gamma(f_0(980)\pi^-)$					Γ_6/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.25		CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+\pi^-\pi^- p$
<0.14	90	AMELIN	95B	VES	$36 \pi^- A \rightarrow \pi^+\pi^-\pi^- A$

NODE=M075R6
NODE=M075R6

$\Gamma(\eta\eta\pi^-)/\Gamma(\pi^+\pi^-\pi^-)$					Γ_7/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.5 ± 0.1	1200	16 AMELIN	96B	VES	$37 \pi^- A \rightarrow \eta\eta\pi^- A$

NODE=M075R8
NODE=M075R8

$\Gamma(a_2(1320)\eta)/\Gamma_{\text{total}}$					Γ_9/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R13
NODE=M075R13

$\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$					Γ_{10}/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R14
NODE=M075R14

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$					Γ_{11}/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
not seen	EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$	

NODE=M075R15
NODE=M075R15

$\Gamma(f_0(1500)\pi^-)/\Gamma(a_0(980)\eta)$ Γ_{12}/Γ_8

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M075R7
 NODE=M075R7

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.48 ± 0.17	4k ^{16,17}	EUGENIO	08	B852	—	18 $\pi^- p \rightarrow \eta\eta\pi^- p$
0.030 ^{+0.014} -0.011		¹⁶ ANISOVICH	01B	SPEC	0	0.6-1.94 $p\bar{p} \rightarrow \eta\eta\pi^0\pi^0$
0.08 ± 0.03	1200 ^{16,18}	AMELIN	96B	VES	—	37 $\pi^- A \rightarrow \eta\eta\pi^- A$

 $\Gamma(\eta\eta'(958)\pi^-)/\Gamma(\eta\eta\pi^-)$ Γ_{13}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M075R10
 NODE=M075R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.29 ± 0.07		¹⁶ BELADIDZE	92C	VES	—	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
0.3 ± 0.1	426 ± 57	¹⁶ BITYUKOV	91	VES	—	36 $\pi^- C \rightarrow \pi^- \eta\eta C$

 $\Gamma(K_0^*(1430)K^-)/\Gamma_{total}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M075R4
 NODE=M075R4

seen BERDNIKOV 94 VES — 37 $\pi^- A \rightarrow K^+ K^- \pi^- A$

 $\Gamma(K^*(892)K^-)/\Gamma_{total}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
-------	-------------	------	-----	---------

NODE=M075R9
 NODE=M075R9

not seen BERDNIKOV 94 VES — 37 $\pi^- A \rightarrow K^+ K^- \pi^- A$

¹⁵ Assuming that $f_0(980)$ decays only to $\pi\pi$.

¹⁶ Systematic errors not estimated.

¹⁷ From a single-pole fit.

¹⁸ Assuming that $f_0(1500)$ decays only to $\eta\eta$ and $a_0(980)$ decays only to $\eta\pi$.

NODE=M075R;LINKAGE=CK
 NODE=M075R5;LINKAGE=NS
 NODE=M075R7;LINKAGE=SP
 NODE=M075R7;LINKAGE=A

 $\pi(1800)$ REFERENCES

NODE=M075

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
EUGENIO	08	PL B660 466	P. Eugenio <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL) IGJPC
		Translated from YAF 59 1021.		
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
BITYUKOV	91	PL B268 137	S.I. Bityukov <i>et al.</i>	(SERP, TBIL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)

REFID=59471
 REFID=53356
 REFID=52160
 REFID=48837
 REFID=48318
 REFID=46910
 REFID=44725
 REFID=44433
 REFID=44073
 REFID=43175
 REFID=41749
 REFID=21134

$f_2(1810)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M038

NODE=M038

NODE=M038M

NODE=M038M

$f_2(1810)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1815 ±12	OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.		
1822 $\begin{smallmatrix} +29 \\ -24 \end{smallmatrix}$	$\begin{smallmatrix} +66 \\ -57 \end{smallmatrix}$	5.5k	1 ABLIKIM	13N BES3 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
1737 ± 9	$\begin{smallmatrix} +198 \\ -65 \end{smallmatrix}$		2 UEHARA	10A BELL $10.6 e^+e^- \rightarrow e^+e^-\eta\eta$
1800 ±30	40		ALDE	88D GAM4 $300 \pi^-p \rightarrow \pi^-p4\pi^0$
1806 ±10	1600		ALDE	87 GAM4 $100 \pi^-p \rightarrow 4\pi^0n$
1870 ±40			3 ALDE	86D GAM4 $100 \pi^-p \rightarrow \eta\eta n$
1857 $\begin{smallmatrix} +35 \\ -24 \end{smallmatrix}$			4 COSTA	80 OMEG $10 \pi^-p \rightarrow K^+K^-n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1845.0 ± 2.2 $\begin{smallmatrix} + \\ - \end{smallmatrix}$	$\begin{smallmatrix} 1.6 \\ 7.2 \end{smallmatrix}$		5 ALBRECHT	20 RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
1858 $\begin{smallmatrix} +18 \\ -71 \end{smallmatrix}$			6 LONGACRE	86 RVUE Compilation
1799 ±15			7 CASON	82 STRC $8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

- ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
- ² Breit-Wigner mass. Could also be the $f_2(1910)$.
- ³ Seen in only one solution.
- ⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
- ⁵ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).
- ⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
- ⁷ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038M;LINKAGE=B

NODE=M038M;LINKAGE=UE

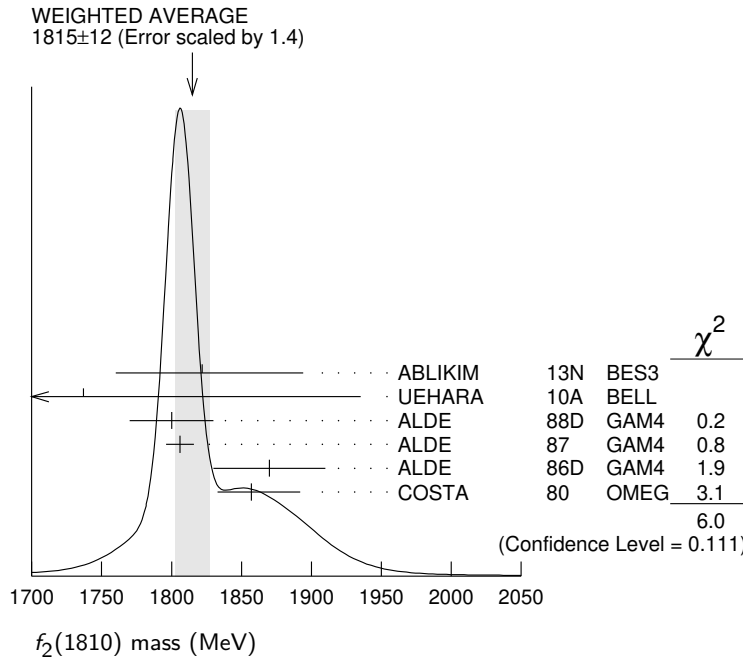
NODE=M038M;LINKAGE=F

NODE=M038M;LINKAGE=A

NODE=M038M;LINKAGE=C

NODE=M038M;LINKAGE=L

NODE=M038M;LINKAGE=P1



$f_2(1810)$ WIDTH

NODE=M038W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
197 ± 22	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
229 +52 -42	+88 -155	5.5k	1 ABLIKIM 13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
228 +21 -20	+234 -153		2 UEHARA 10A BELL	$10.6 e^+e^- \rightarrow e^+e^-\eta\eta$
160 ± 30	40	ALDE 88D	GAM4	$300 \pi^-p \rightarrow \pi^-p4\pi^0$
190 ± 20	1600	ALDE 87	GAM4	$100 \pi^-p \rightarrow 4\pi^0n$
250 ± 30		3 ALDE 86D	GAM4	$100 \pi^-p \rightarrow \eta\eta n$
185 +102 -139		4 COSTA 80	OMEG	$10 \pi^-p \rightarrow K^+K^-n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

260.9 ± 3.9	+199.9 -38.2	5 ALBRECHT 20	RVUE	$0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
388 +15 -21		6 LONGACRE 86	RVUE	Compilation
280 +42 -35		7 CASON 82	STRC	$8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

- ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
- ² Breit-Wigner width. Could also be the $f_2(1910)$.
- ³ Seen in only one solution.
- ⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
- ⁵ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).
- ⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
- ⁷ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

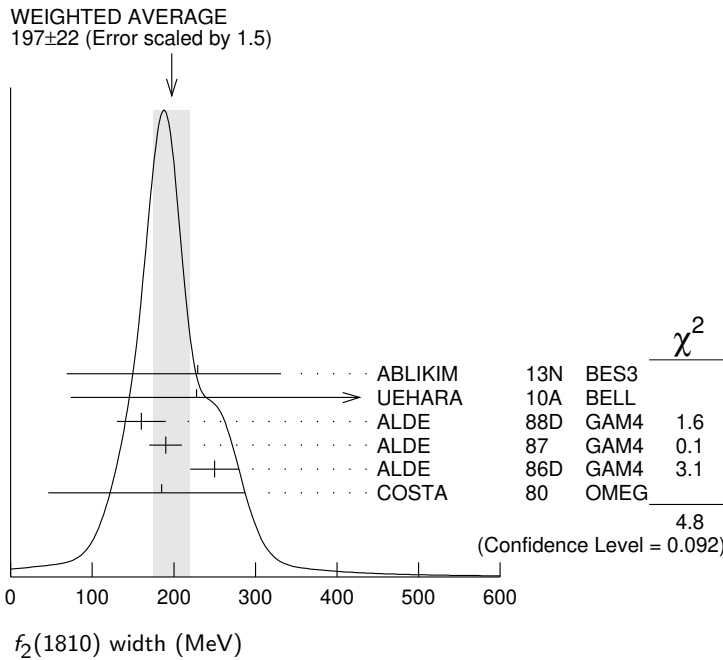
NODE=M038W

NODE=M038W;LINKAGE=B

NODE=M038W;LINKAGE=UE
 NODE=M038W;LINKAGE=F
 NODE=M038W;LINKAGE=A
 NODE=M038W;LINKAGE=C

NODE=M038W;LINKAGE=L

NODE=M038W;LINKAGE=P1



$f_2(1810)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\eta\eta$	seen
Γ_3 $4\pi^0$	seen
Γ_4 K^+K^-	seen
Γ_5 $\gamma\gamma$	seen

NODE=M038215;NODE=M038

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←

$f_2(1810) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M038225

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_5/\Gamma$

VALUE (eV)

DOCUMENT ID TECN COMMENT

 $5.2^{+0.9+37.3}_{-0.8-4.5}$ ¹ UEHARA 10A BELL 10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$ NODE=M038G01
NODE=M038G01¹ Including interference with the $f'_2(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M038G01;LINKAGE=UE

 $f_2(1810)$ BRANCHING RATIOS

NODE=M038220

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen

AMSLER 02 CBAR 0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$

not seen

PROKOSHKIN 97 GAM2 38 $\pi^-p \rightarrow \pi^0\pi^0n$ $0.21^{+0.02}_{-0.03}$ ¹ LONGACRE 86 RVUE Compilation 0.44 ± 0.03 ² CASON 82 STRC 8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$ NODE=M038R2
NODE=M038R2¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R2;LINKAGE=L

² Included in LONGACRE 86 global analysis.

NODE=M038R;LINKAGE=C

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE

DOCUMENT ID TECN COMMENT

seen

ABLIKIM 13N BES3 PWA of $J/\psi \rightarrow \gamma\eta\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $0.008^{+0.028}_{-0.003}$ ¹ LONGACRE 86 RVUE CompilationNODE=M038R3
NODE=M038R3¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R3;LINKAGE=L

 $\Gamma(\pi\pi)/\Gamma(4\pi^0)$ Γ_1/Γ_3

VALUE

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.75

ALDE 87 GAM4 100 $\pi^-p \rightarrow 4\pi^0n$ NODE=M038R4
NODE=M038R4 $\Gamma(4\pi^0)/\Gamma(\eta\eta)$ Γ_3/Γ_2

VALUE

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 0.8 ± 0.3 ALDE 87 GAM4 100 $\pi^-p \rightarrow 4\pi^0n$ NODE=M038R5
NODE=M038R5 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $0.003^{+0.019}_{-0.002}$ ¹ LONGACRE 86 RVUE Compilation

seen

COSTA 80 OMEG 10 $\pi^-p \rightarrow K^+K^-n$ NODE=M038R1
NODE=M038R1¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R1;LINKAGE=L

 $f_2(1810)$ REFERENCES

NODE=M038

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
PROKOSHKIN	97	PD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)	REFID=45386
ALDE	88D	Translated from DANS 353 323. SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44652
ALDE	87	Translated from YAF 47 1273. PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355

X(1835)

$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Could be a superposition of two states, one appearing as threshold enhancement in $p\bar{p}$ the other one with a lower mass at 1835 MeV. Coupled-channel analyses with more sophisticated model are needed.

NODE=M085

NODE=M085

X(1835) MASS

NODE=M085M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M085M

1831.8^{+4.0}_{-2.6} OUR AVERAGE

NEW

[1826.5^{+13.0}_{-3.4} MeV OUR 2024 AVERAGE]1832.5 ± 3.1 ± 2.5 21k 1 ABLIKIM 24B BES3 $J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

OCCUR=2

1825.3 ± 2.4^{+17.3}_{-2.4} 2 ABLIKIM 16J BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$ 1844 ± 9⁺¹⁶₋₂₅ 3 ABLIKIM 15T BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1818 ± 9 ± 2.5 37k 4 ABLIKIM 24B BES3 $J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

OCCUR=2

1839 ± 26 ± 26 5 ABLIKIM 18I BES3 $J/\psi \rightarrow \gamma \gamma \phi(1020)$ 1909.5 ± 15.9^{+9.4}_{-27.5} 6 ABLIKIM 16J BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$ 1842.2 ± 4.2^{+7.1}_{-2.6} 0.6k 7 ABLIKIM 13U BES3 $J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$ 1832⁺¹⁹₋₅ ± 26 8 ABLIKIM 12D BES3 $J/\psi \rightarrow \gamma p\bar{p}$ 1836.5 ± 3.0^{+5.6}_{-2.1} 4265 9 ABLIKIM 11C BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$ 1877.3 ± 6.3^{+3.4}_{-7.4} 10 ABLIKIM 11J BES3 $J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$ 1837⁺¹⁰₋₁₂ ± 9⁺⁹₋₇ 231^{11,12} ALEXANDER 10 CLEO $J/\psi \rightarrow \gamma p\bar{p}$ 1833.7 ± 6.1 ± 2.7 264 ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$ 1831 ± 7 12,13 ABLIKIM 05R BES2 $J/\psi \rightarrow \gamma p\bar{p}$

OCCUR=2

1859⁺³₋₁₀ ± 5⁺⁵₋₂₅ 12 BAI 03F BES2 $J/\psi \rightarrow \gamma p\bar{p}$

¹ From a fit of the measured $3(\pi^+ \pi^-)$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1880 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known background contributions. A second solution of the fit gives 37k events.

NODE=M085M;LINKAGE=E

² From a fit of the measured $\pi^+ \pi^- \eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.

NODE=M085M;LINKAGE=B

³ Decay dominated by $f_0(980)\eta$ hence $I^G(J^{PC}) = 0^+(0^-+)$.

NODE=M085M;LINKAGE=D

⁴ From a fit of the measured $3(\pi^+ \pi^-)$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold. The fit also includes known background contributions.

NODE=M085M;LINKAGE=G

⁵ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^-+$. Other J^{PC} not excluded.

NODE=M085M;LINKAGE=C

⁶ Pole mass from a fit of the measured $\pi^+ \pi^- \eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.

NODE=M085M;LINKAGE=A

⁷ Superseded by ABLIKIM 24B.

NODE=M085M;LINKAGE=F

⁸ From the fit including final state interaction effects in isospin 0 *S*-wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

NODE=M085M;LINKAGE=AK

⁹ From a fit of the $\pi^+ \pi^- \eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma \eta(2370)$, for $M(\pi^+ \pi^- \eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0 \pi^+ \pi^- \eta'$.

NODE=M085M;LINKAGE=AI

¹⁰ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$ with $B(J/\psi \rightarrow \omega X \rightarrow \omega a_0(980)\pi^\pm (\rightarrow \eta \pi^\pm) \pi^\mp) = (1.50 \pm 0.26^{+0.72}_{-0.36}) \times 10^{-4}$. Not seen in $J/\psi(1S) \rightarrow \omega K^+ K^- \eta$ by ABLIKIM 24BQ with 90% CL upper limit of 9.55×10^{-7} . This state may be also due to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.

NODE=M085M;LINKAGE=BL

¹¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M085M;LINKAGE=AE

¹² Evidence for a threshold enhancement in the $p\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p\bar{p}K^+$, WANG 05A in $B^0 \rightarrow$

NODE=M085M;LINKAGE=HF

$\rho\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow \rho\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)\rho\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow \rho\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow \rho\bar{p}\gamma$.

¹³From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085M;LINKAGE=AB

X(1835) WIDTH

NODE=M085W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
120 ±70 OUR AVERAGE					Error includes scale factor of 8.8. [242 ⁺¹⁴ ₋₁₅ MeV OUR 2024 AVERAGE]
80.7 ± 5.2 ± 7.7		21k	¹ ABLIKIM	24B BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
245.2 ± 13.1 ^{+4.6} _{-9.6}			² ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma \pi^+\pi^-\eta'$
192 ⁺²⁰ ₋₁₇ ⁺⁶² ₋₄₃			³ ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
175 ± 57 ± 25			⁴ ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
273.5 ± 21.4 ^{+6.1} _{-64.0}			⁵ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma \pi^+\pi^-\eta'$
83 ± 14 ± 11		0.6k	⁶ ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
< 76	90		⁷ ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma \rho\bar{p}$
190 ± 9 ⁺³⁸ ₋₃₆		4265	⁸ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+\pi^-\eta'$
57 ± 12 ⁺¹⁹ ₋₄			⁹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
0 ⁺⁴⁴ ₋₀		231	^{10,11} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma \rho\bar{p}$
67.7 ± 20.3 ± 7.7		264	ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma \pi^+\pi^-\eta'$
< 153	90		^{11,12} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma \rho\bar{p}$
< 30			¹¹ BAI	03F BES2	$J/\psi \rightarrow \gamma \rho\bar{p}$

NODE=M085W

NEW

OCCUR=2

OCCUR=2

¹ From a fit of the measured $3(\pi^+\pi^-)$ lineshape that accounts for the abrupt distortion observed at the $\rho\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1880 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known background contributions. A second solution of the fit gives 37k events.

NODE=M085W;LINKAGE=E

² From a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $\rho\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.

NODE=M085W;LINKAGE=B

³ Decay dominated by $f_0(980)\eta$ hence $I^G(J^{PC}) = 0^+(0^-+)$.

NODE=M085W;LINKAGE=D

⁴ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^-+$. Other J^{PC} not excluded.

NODE=M085W;LINKAGE=C

⁵ Pole width from a fit of the measured $\pi^+\pi^-\eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $\rho\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.

NODE=M085W;LINKAGE=A

⁶ Superseded by ABLIKIM 24B.

NODE=M085W;LINKAGE=F

⁷ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

NODE=M085W;LINKAGE=AK

⁸ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma \eta(2370)$, for $M(\pi^+\pi^-\eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

NODE=M085W;LINKAGE=AI

⁹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$ with $B(J/\psi \rightarrow \omega X \rightarrow \omega a_0(980)^\pm (\rightarrow \eta\pi^\pm)\pi^\mp) = (1.50 \pm 0.26_{-0.36}^{+0.72}) \times 10^{-4}$. Not seen in $J/\psi(1S) \rightarrow \omega K^+ K^- \eta$ by ABLIKIM 24BQ with 90% CL upper limit of 9.55×10^{-7} . This state may be also due to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.

NODE=M085W;LINKAGE=BL

¹⁰ From a fit of the $\rho\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma\rho\bar{p}$ phase space, for $M(\rho\bar{p}) < 2.85$ GeV.

NODE=M085W;LINKAGE=AE

¹¹ Evidence for a threshold enhancement in the $\rho\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT, B 05L, and WANG 05A in $B^+ \rightarrow \rho\bar{p}K^+$, WANG 05A in $B^0 \rightarrow \rho\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow \rho\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)\rho\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow \rho\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow \rho\bar{p}\gamma$.

NODE=M085W;LINKAGE=HF

¹² From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085W;LINKAGE=AB

X(1835) DECAY MODES

NODE=M085215;NODE=M085

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\eta'\pi^+\pi^-$	seen
Γ_3 $\gamma\gamma$	not seen
Γ_4 $K_S^0 K_S^0 \eta$	seen
Γ_5 $\gamma\phi(1020)$	possibly seen
Γ_6 $3(\pi^+\pi^-)$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7

X(1835) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M085225

 $\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_3/\Gamma$

NODE=M085G01
NODE=M085G01

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<35.6	90	¹ ZHANG	12A	BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
<83	90	² ZHANG	12A	BELL $e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

OCCUR=2

¹ From a two-resonance fit and constructive interference of the $\eta(1760)$ and X(1835), a significance of 2.8 σ .

NODE=M085G01;LINKAGE=ZH

² From a two-resonance fit and destructive interference of the $\eta(1760)$ and X(1835), a significance of 2.8 σ .

NODE=M085G01;LINKAGE=ZA

X(1835) BRANCHING RATIOS

NODE=M085220

 $\Gamma(p\bar{p})/\Gamma(\eta'\pi^+\pi^-)$ Γ_1/Γ_2

NODE=M085R01
NODE=M085R01

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.333	ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
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 $\Gamma(\eta'\pi^+\pi^-)/\Gamma(K_S^0 K_S^0 \eta)$ Γ_2/Γ_4

NODE=M085R00
NODE=M085R00

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

6.7 ± 1.8	¹ ABLIKIM	15T	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
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¹ Using results from ABLIKIM 05R.

NODE=M085R00;LINKAGE=A

 $\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

NODE=M085R03
NODE=M085R03

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ¹ ABLIKIM 16J BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

¹ ABLIKIM 16J quotes $B(J/\psi \rightarrow \gamma X(1835)) \times B(X(1835) \rightarrow \pi^+\pi^-\eta') = (3.93 \pm 0.38^{+0.31}_{-0.84}) \times 10^{-4}$ from a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the X(1835); fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

NODE=M085R03;LINKAGE=A

 $\Gamma(\gamma\phi(1020))/\Gamma_{\text{total}}$ Γ_5/Γ

NODE=M085R04
NODE=M085R04

VALUE	DOCUMENT ID	TECN	COMMENT
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possibly seen ¹ ABLIKIM 18I BES3 $J/\psi \rightarrow \gamma\gamma\phi(1020)$

¹ Seen as a peak in $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

NODE=M085R04;LINKAGE=A

 $\Gamma(\gamma\gamma)/\Gamma(\eta'\pi^+\pi^-)$ Γ_3/Γ_2

NODE=M085R05
NODE=M085R05

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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< 9.80×10^{-3} 90 ¹ ABLIKIM 180 BES3 $\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

¹ Using results from ABLIKIM 16J.

NODE=M085R05;LINKAGE=A

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	21k	¹ ABLIKIM	24B BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
seen	0.6k	² ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
¹ ABLIKIM 24B quotes $B(J/\psi \rightarrow \gamma X(1835)) \times B(X(1835) \rightarrow 3(\pi^+\pi^-)) = (1.19 \pm 0.30 \pm 0.15) \times 10^{-5}$ for constructive interference and $(2.07 \pm 0.50 \pm 0.36) \times 10^{-5}$ for destructive interference from a fit of the measured $3(\pi^+\pi^-)$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second narrow resonance near 1880 MeV. The solution for destructive interference gives 37k events.				
² Superseded by ABLIKIM 24B.				

NODE=M085R06
NODE=M085R06

NODE=M085R06;LINKAGE=A

NODE=M085R06;LINKAGE=B

X(1835) REFERENCES

ABLIKIM	24B	PRL 132 151901	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	24BQ	PR D110 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	16J	PRL 117 042002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.) JPC
DEL-AMO-SA...	12	PR D85 092017	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	10G	CP C34 421	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
WEI	08	PL B659 80	J.-T. Wei <i>et al.</i>	(BELLE Collab.)
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT,B	05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer	
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)
ABE	02K	PRL 88 181803	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	02W	PRL 89 151802	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M085

REFID=62651
REFID=63020
REFID=58893
REFID=58925
REFID=57454
REFID=56785
REFID=55582
REFID=54269
REFID=54286
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REFID=52086
REFID=50993
REFID=50985
REFID=50827
REFID=51038
REFID=50651
REFID=49473
REFID=48690
REFID=48980

$\phi_3(1850)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M054

$\phi_3(1850)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1854 ± 7 OUR AVERAGE				
1855 ± 10		ASTON	88E LASS	$11 K^- p \rightarrow K^- K^+ \Lambda, K_S^0 K^\pm \pi^\mp \Lambda$
1870 ⁺³⁰ ₋₂₀	430	ARMSTRONG	82 OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
1850 ± 10	123	ALHARRAN	81B HBC	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054M

NODE=M054M

$\phi_3(1850)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
87⁺²⁸₋₂₃ OUR AVERAGE Error includes scale factor of 1.2.				
64 ± 31		ASTON	88E LASS	$11 K^- p \rightarrow K^- K^+ \Lambda, K_S^0 K^\pm \pi^\mp \Lambda$
160 ⁺⁹⁰ ₋₅₀	430	ARMSTRONG	82 OMEG	$18.5 K^- p \rightarrow K^- K^+ \Lambda$
80 ⁺⁴⁰ ₋₃₀	123	ALHARRAN	81B HBC	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054W

NODE=M054W

$\phi_3(1850)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $K \bar{K}^*(892) + c.c.$	seen

NODE=M054215;NODE=M054

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←

$\phi_3(1850)$ BRANCHING RATIOS

NODE=M054220

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
$0.55^{+0.85}_{-0.45}$	ASTON	88E LASS	11 $K^- p \rightarrow K^- K^+ \Lambda$, $K_S^0 K^\pm \pi^\mp \Lambda$

NODE=M054R1
NODE=M054R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.8 ± 0.4	ALHARRAN	81B HBC	8.25 $K^- p \rightarrow K\bar{K}\pi\Lambda$
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 $\phi_3(1850)$ REFERENCES

NODE=M054

ASTON	88E	PL B208 324	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) IGJPC
ARMSTRONG	82	PL 110B 77	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP
ALHARRAN	81B	PL 101B 357	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)

REFID=40577
REFID=21405
REFID=21702 $\eta_1(1855)$

$$I^G(J^{PC}) = 0^+(1^-+)$$

NODE=M267

OMITTED FROM SUMMARY TABLE

Meson with exotic (non- $q\bar{q}$) quantum numbers. A state decaying into $\eta\eta'$ with possible quantum numbers 1^-+ was reported earlier in this mass region BARBERIS 00A in high energy central pp production and by ALDE 91B in $\pi^- p$ interactions, see the $f_2(1910)$, and the review on "Spectroscopy of Light Meson Resonances."

NODE=M267

 $\eta_1(1855)$ MASS

NODE=M267M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1855 \pm 9^{+6}_{-1}$	¹ ABLIKIM	22A1 BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$

NODE=M267M

¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P -wave. For analysis details see ABLIKIM 22AS.

NODE=M267M;LINKAGE=A

 $\eta_1(1855)$ WIDTH

NODE=M267W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$188 \pm 18^{+3}_{-8}$	¹ ABLIKIM	22A1 BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$

NODE=M267W

¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P -wave. For analysis details see ABLIKIM 22AS.

NODE=M267W;LINKAGE=A

 $\eta_1(1855)$ DECAY MODES

NODE=M267215;NODE=M267

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta\eta'$	seen

DESIG=1

 $\eta_1(1855)$ BRANCHING RATIOS

NODE=M267225

 $\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	22A1 BES3	$J/\psi \rightarrow \gamma\eta\eta'$
seen	BARBERIS	00A	450 $pp \rightarrow p_f \eta\eta' p_s$
seen	ALDE	91B GAM2	38 $\pi^- p \rightarrow \eta\eta' n$

NODE=M267R00
NODE=M267R00 $\eta_1(1855)$ REFERENCES

NODE=M267

ABLIKIM	22A1	PRL 129 192002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errata)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)

Translated from YAF 54 751.

REFID=61881
REFID=61891
REFID=61891
REFID=62033
REFID=47957
REFID=41844

$\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M101

 $\eta_2(1870)$ MASS

NODE=M101M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1842 ± 8 OUR AVERAGE				
1835 ± 12		BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1844 ± 13		BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
1840 ± 25		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1875 ± 20 ± 35		ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1881 ± 32 ± 40	26	KARCH	92 CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1860 ± 5 ± 15		ANISOVICH	00E SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1840 ± 15		BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101M

 $\eta_2(1870)$ WIDTH

NODE=M101W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
225 ± 14 OUR AVERAGE				
235 ± 22		BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
228 ± 23		BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
200 ± 40		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
200 ± 25 ± 45		ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
221 ± 92 ± 44	26	KARCH	92 CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
250 ± 25 ⁺⁵⁰ ₋₃₅		ANISOVICH	00E SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
170 ± 40		BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101W

 $\eta_2(1870)$ DECAY MODES

NODE=M101225;NODE=M101

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta \pi \pi$	seen
Γ_2 $a_2(1320) \pi$	seen
Γ_3 $f_2(1270) \eta$	seen
Γ_4 $a_0(980) \pi$	seen
Γ_5 $\gamma \gamma$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=9

 $\eta_2(1870)$ BRANCHING RATIOS

NODE=M101230

 $\Gamma(a_2(1320)\pi)/\Gamma(f_2(1270)\eta)$ Γ_2/Γ_3 NODE=M101R2
NODE=M101R2

VALUE	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4 OUR AVERAGE			
1.60 ± 0.40	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$
20.4 ± 6.6	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
4.1 ± 2.3	ADOMEIT	96	CBAR 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

¹Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M101R2;LINKAGE=AN

 $\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$ Γ_2/Γ_4 NODE=M101R4
NODE=M101R4

VALUE	DOCUMENT ID	COMMENT
32.6 ± 12.6	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

 $\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta)$ Γ_4/Γ_3 NODE=M101R01
NODE=M101R01

VALUE	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.45	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

¹Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M101R01;LINKAGE=AN

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ NODE=M101R02
NODE=M101R02

VALUE	DOCUMENT ID	TECN	COMMENT
seen	KARCH	92	CBAL $e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$

$\eta_2(1870)$ REFERENCES

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)

NODE=M101

REFID=53631
REFID=47945
REFID=47958
REFID=47959
REFID=46606
REFID=45758
REFID=45202
REFID=42170

$\pi_2(1880)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M185

$\pi_2(1880)$ MASS

NODE=M185M

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

NODE=M185M

1874⁺²⁶₋₅ OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

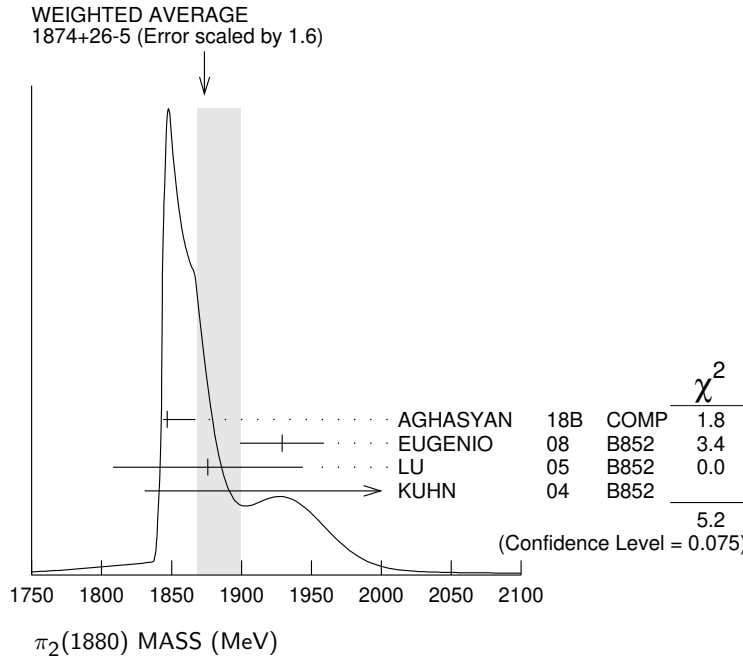
1847 ⁺²⁰ ₋₃	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1929 \pm 24 \pm 18	4k	EUGENIO	08	B852	- 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1876 \pm 11 \pm 67	145k	LU	05	B852	- 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
2003 \pm 88 \pm 148	69k	KUHN	04	B852	- 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1880 \pm 20		ANISOVICH	01B	SPEC	0 0.6-1.94 $\bar{p} p \rightarrow \eta \eta \pi^0 \pi^0$
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NODE=M185M;LINKAGE=A

¹Statistical error negligible.



$\pi_2(1880)$ WIDTH

NODE=M185W

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

NODE=M185W

237⁺³³₋₃₀ OUR AVERAGE Error includes scale factor of 1.2.

246 ⁺³³ ₋₂₈	46M	² AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
323 \pm 87 \pm 43	4k	EUGENIO	08	B852	- 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
146 \pm 17 \pm 62	145k	LU	05	B852	- 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
306 \pm 132 \pm 121	69k	KUHN	04	B852	- 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

255 \pm 45		ANISOVICH	01B	SPEC	0 0.6-1.94 $\bar{p} p \rightarrow \eta \eta \pi^0 \pi^0$
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²Statistical error negligible.

NODE=M185W;LINKAGE=A

$\pi_2(1880)$ DECAY MODES

NODE=M185215;NODE=M185

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\eta\pi^-$	seen
Γ_2 $a_0(980)\eta$	seen
Γ_3 $a_2(1320)\eta$	seen
Γ_4 $f_0(1500)\pi$	seen
Γ_5 $f_1(1285)\pi$	seen
Γ_6 $\omega\pi^-\pi^0$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$ Γ_3/Γ_5

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

22.7±7.3	69k	KUHN	04	B852	–	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
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NODE=M185R01
NODE=M185R01

 $\Gamma(f_0(1500)\pi)/\Gamma(a_0(980)\eta)$ Γ_4/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

0.28 ^{+0.20} _{-0.15}	³ ANISOVICH	01B	SPEC	0	0.6–1.94 $\bar{p}p \rightarrow \eta\eta\pi^0\pi^0$
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³Systematic errors not estimated.

NODE=M185R02
NODE=M185R02

NODE=M185R02;LINKAGE=NS

 $\pi_2(1880)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
EUGENIO	08	PL B660 466	P. Eugenio <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	

NODE=M185

REFID=59471
REFID=52160
REFID=50459
REFID=49773
REFID=48318

$\rho(1900)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

OMITTED FROM SUMMARY TABLE

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M170

NODE=M170

 $\rho(1900)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

1880±10		¹ ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \rightarrow K^+K^-\pi^0$
1909±17±25	54	² AUBERT	08S	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
1880±30		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 3\pi^+3\pi^-\gamma$
1860±20		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
1910±10		^{3,4} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
1870±10		ANTONELLI	96	SPEC	$e^+e^- \rightarrow$ hadrons

NODE=M170M

NODE=M170M

OCCUR=2

¹ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

² From the fit with two resonances.

³ From a fit with two resonances with the JACOB 72 continuum.

⁴ Supersedes FRABETTI 01.

NODE=M170M;LINKAGE=A

NODE=M170M;LINKAGE=AU
NODE=M170M;LINKAGE=PI
NODE=M170M;LINKAGE=RS

 $\rho(1900)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

69±15		¹ ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \rightarrow K^+K^-\pi^0$
48±17±2	54	² AUBERT	08S	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
130±30		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 3\pi^+3\pi^-\gamma$
160±20		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
37±13		^{3,4} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
10±5		ANTONELLI	96	SPEC	$e^+e^- \rightarrow$ hadrons

NODE=M170W

NODE=M170W

OCCUR=2

- ¹ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.
- ² From the fit with two resonances.
- ³ From a fit with two resonances with the JACOB 72 continuum.
- ⁴ Supersedes FRABETTI 01.

NODE=M170W;LINKAGE=A

NODE=M170W;LINKAGE=AU
NODE=M170W;LINKAGE=PI
NODE=M170W;LINKAGE=RS $\rho(1900) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$ $\Gamma(\phi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_6/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.2 \pm 1.2 \pm 0.8$	54	¹ AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \phi\pi^0\gamma$
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¹ From the fit with two resonances.

NODE=M170215

NODE=M170B01
NODE=M170B01

NODE=M170B01;LINKAGE=AU

 $\rho(1900)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 6π	seen
Γ_2 $3\pi^+3\pi^-$	seen
Γ_3 $2\pi^+2\pi^-2\pi^0$	
Γ_4 $\phi\pi$	seen
Γ_5 hadrons	seen
Γ_6 e^+e^-	seen
Γ_7 NN	not seen

NODE=M170225;NODE=M170

DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ← $\rho(1900)$ BRANCHING RATIOS

$\Gamma(6\pi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	8k	AKHMETSHIN 13	CMD3	$e^+e^- \rightarrow 3\pi^+3\pi^-$	
not seen		AGNELLO 02	OBLX	$\bar{n}p \rightarrow 3\pi^+2\pi^-\pi^0$	
seen		FRABETTI 01	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$	
seen		ANTONELLI 96	SPEC	$e^+e^- \rightarrow \text{hadrons}$	

NODE=M170230

NODE=M170R1
NODE=M170R1 $\rho(1900)$ REFERENCES

ABLIKIM 22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AKHMETSHIN 13	PL B723 82	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT 06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
FRABETTI 04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AGNELLO 02	PL B527 39	M. Agnello <i>et al.</i>	(OBELIX Collab.)
FRABETTI 01	PL B514 240	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ANTONELLI 96	PL B365 427	A. Antonelli <i>et al.</i>	(FENICE Collab.)
JACOB 72	PR D5 1847	M. Jacob, R. Slansky	

NODE=M170

REFID=61649
REFID=55370
REFID=52242
REFID=51047
REFID=49614
REFID=48576
REFID=48350
REFID=44633
REFID=49668

$f_2(1910)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

We list here three different peaks with close masses and widths seen in the mass distributions of $\omega\omega$, $\eta\eta'$, and K^+K^- final states. ALDE 91B argues that they are of different nature.

NODE=M142

NODE=M142

 $f_2(1910)$ MASS

NODE=M142205

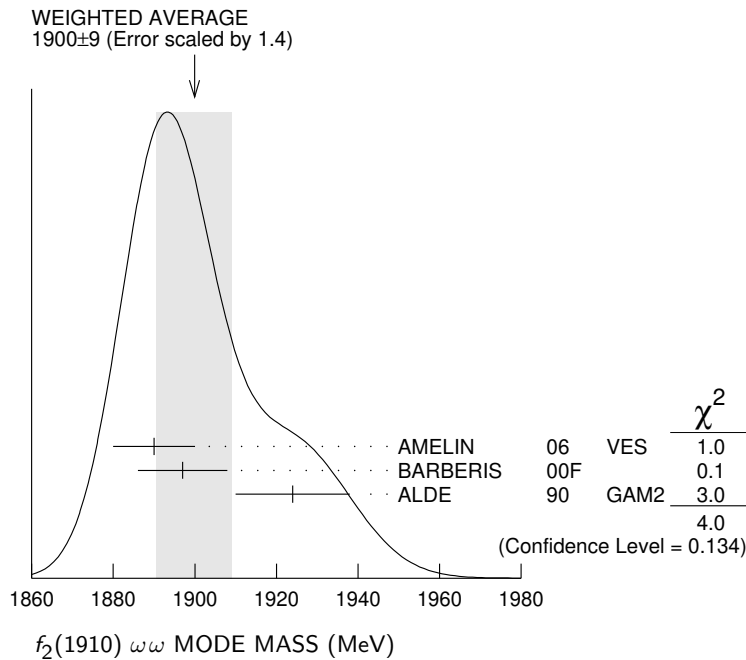
NODE=M142MX

 $f_2(1910)$ $\omega\omega$ MODENODE=M142M2
NODE=M142M2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1900 ± 9 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.		
1890 ± 10	¹ AMELIN	06	VES 36 $\pi^- p \rightarrow \omega\omega n$
1897 ± 11	BARBERIS	00F	450 $p p \rightarrow p_f \omega \omega p_S$
1924 ± 14	ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega\omega n$

¹ Supersedes BELADIDZE 92B.

NODE=M142M2;LINKAGE=AM

 **$f_2(1910)$ $\eta\eta'$ MODE**NODE=M142M3
NODE=M142M3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934 ± 16	¹ BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta' p_S$
1934 ± 20	² ANISOVICH	00J	SPEC
1911 ± 10	ALDE	91B	GAM2 38 $\pi^- p \rightarrow \eta \eta' n$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

¹ Also compatible with $J^{PC} = 1^-+$.² Combined fit with $\eta\eta$, $\pi\pi$, and $\eta\pi\pi$.NODE=M142M3;LINKAGE=KS
NODE=M142M3;LINKAGE=AN **$f_2(1910)$ K^+K^- MODE**NODE=M142M4
NODE=M142M4

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1941 ± 18	¹ AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$

¹ Tentative, could be $f_2(1950)$.

NODE=M142M4;LINKAGE=A

$f_2(1910)$ WIDTH

NODE=M142210

NODE=M142WX

NODE=M142W2

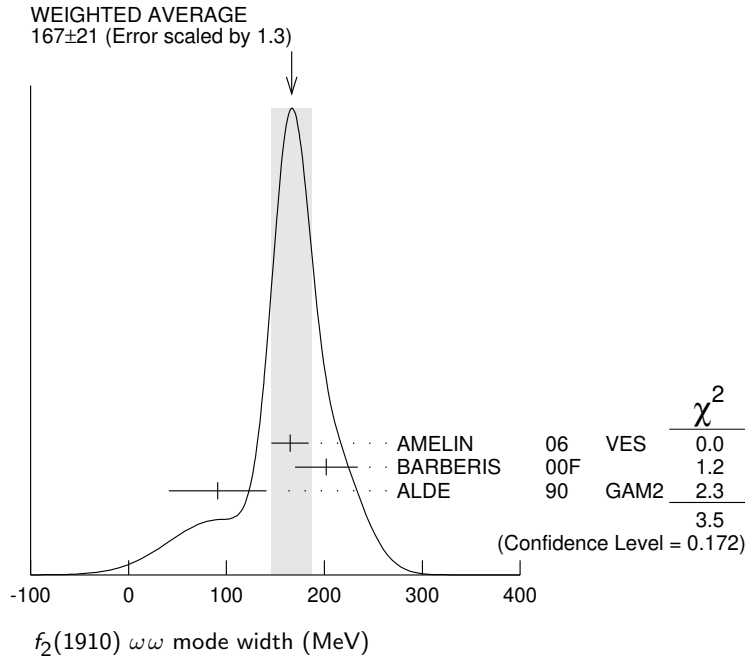
NODE=M142W2

 $f_2(1910)$ $\omega\omega$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
167±21 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
165±19	¹ AMELIN	06 VES	36 $\pi^- p \rightarrow \omega\omega n$
202±32	BARBERIS	00F	450 $pp \rightarrow p_f\omega\omega p_S$
91±50	ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega\omega n$

¹ Supersedes BELADIDZE 92B.

NODE=M142W2;LINKAGE=AM

 **$f_2(1910)$ $\eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141±41	¹ BARBERIS	00A	450 $pp \rightarrow p_f\eta\eta' p_S$
271±25	² ANISOVICH	00J SPEC	
90±35	ALDE	91B GAM2	38 $\pi^- p \rightarrow \eta\eta' n$

¹ Also compatible with $J^{PC}=1^-+$.² Combined fit with $\eta\eta$, $\pi\pi$, and $\eta\pi\pi$.

NODE=M142W3

NODE=M142W3

NODE=M142W3;LINKAGE=KS

NODE=M142W3;LINKAGE=AN

 $f_2(1910)$ K^+K^- MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
120±40	AMSLER	06 CBAR	1.64 $\bar{p}p \rightarrow K^+K^-\pi^0$

NODE=M142W4

NODE=M142W4

 $f_2(1910)$ DECAY MODES

NODE=M142215;NODE=M142

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^0\pi^0$	
Γ_2 K^+K^-	seen
Γ_3 $K_S^0 K_S^0$	
Γ_4 $\eta\eta$	seen
Γ_5 $\omega\omega$	seen
Γ_6 $\eta\eta'$	seen
Γ_7 $\eta'\eta'$	
Γ_8 $\rho\rho$	seen
Γ_9 $a_2(1320)\pi$	seen
Γ_{10} $f_2(1270)\eta$	seen

DESIG=6

DESIG=11

DESIG=8

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

$f_2(1910)$ BRANCHING RATIOS $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AMSLER	06	CBAR 1.64 $\bar{p}p \rightarrow K^+K^-\pi^0$

¹ Tentative, could be $f_2(1950)$.

NODE=M142225

NODE=M142R11
NODE=M142R11

NODE=M142R11;LINKAGE=A

 $\Gamma(\pi^0\pi^0)/\Gamma(\eta\eta')$ Γ_1/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
<0.1	ALDE	89	GAM2 $38\pi^-p \rightarrow \eta\eta'n$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R4
NODE=M142R4 $\Gamma(K_S^0K_S^0)/\Gamma(\eta\eta')$ Γ_3/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.066	90	BALOSHIN	86	SPEC $40\pi p \rightarrow K_S^0K_S^0n$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R7
NODE=M142R7 $\Gamma(\eta\eta)/\Gamma(\eta\eta')$ Γ_4/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	ALDE	91B	GAM2 $38\pi^-p \rightarrow \eta\eta'n$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R6
NODE=M142R6 $\Gamma(\omega\omega)/\Gamma(\eta\eta')$ Γ_5/Γ_6

VALUE	DOCUMENT ID	COMMENT
2.6 ± 0.6	BARBERIS 00F	$450 pp \rightarrow p_f\omega\omega p_S$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R10
NODE=M142R10 $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
probably not seen	BARBERIS	00A	$450 pp \rightarrow p_f\eta'\eta' p_S$
possibly seen	BELADIDZE	92D	VES $37\pi^-p \rightarrow \eta'\eta'n$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R8
NODE=M142R8 $\Gamma(\rho\rho)/\Gamma(\omega\omega)$ Γ_8/Γ_5

VALUE	DOCUMENT ID	COMMENT
2.6 ± 0.4	BARBERIS 00F	$450 pp \rightarrow p_f\omega\omega p_S$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M142R9
NODE=M142R9 $\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ Γ_{10}/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
0.09 ± 0.05	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.NODE=M142R12
NODE=M142R12

NODE=M142R12;LINKAGE=AN

 $f_2(1910)$ REFERENCES

NODE=M142

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)	REFID=53631
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>		REFID=47945
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47957
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45202
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42172
BELADIDZE	92D	ZPHY C57 13	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43309
ALDE	91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41844
		Translated from YAF 54 751.			
Also		PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41911
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
ALDE	89	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=40727
Also		SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)	REFID=44697
		Translated from YAF 48 1724.			
BALOSHIN	86	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)	REFID=40734
		Translated from YAF 43 1487.			

$a_0(1950)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

NODE=M227

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen in $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$ by LEES 16A
with significance 2.5σ in $K_S^0 K^\pm \pi^\mp$ and 4.2σ in $K^+ K^- \pi^0$.

NODE=M227

 $a_0(1950)$ MASS

NODE=M227M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1931 \pm 14 \pm 22$	12k	^{1,2} LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
$1949 \pm 32 \pm 76$	8k	¹ LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$1927 \pm 15 \pm 23$	4k	¹ LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$

NODE=M227M

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating width.

² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.

OCCUR=2

NODE=M227M;LINKAGE=A

NODE=M227M;LINKAGE=B

 $a_0(1950)$ WIDTH

NODE=M227W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$271 \pm 22 \pm 29$	12k	^{1,2} LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
$265 \pm 36 \pm 110$	8k	¹ LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$274 \pm 28 \pm 30$	4k	¹ LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$

NODE=M227W

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating mass.

² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.

OCCUR=2

NODE=M227W;LINKAGE=A

NODE=M227W;LINKAGE=B

 $a_0(1950)$ DECAY MODES

NODE=M227215;NODE=M227

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\bar{K}$	seen

DESIG=1

 $a_0(1950)$ BRANCHING RATIOS

NODE=M227225

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES	16A	BABR $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$

NODE=M227R01

NODE=M227R01

¹ From a model-independent partial wave analysis.

NODE=M227R01;LINKAGE=A

 $a_0(1950)$ REFERENCES

NODE=M227

LEES 16A PR D93 012005 J.P. Lees *et al.* (BABAR Collab.)

REFID=57125

$f_2(1950)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M135

 $f_2(1950)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M135PP

NODE=M135PP

NODE=M135PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1830–2020) – i (110–220) OUR ESTIMATE			
$(1955 \pm 75) - i (175 \pm 57)$	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1978.2 \pm 1.8^{+28.4}_{-16.9}) - i$ $(118.8 \pm 0.8^{+20.8}_{-7.8})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$
$(1867 \pm 46) - i (193 \pm 29)$	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).			
² T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).			

NODE=M135PP;LINKAGE=A

NODE=M135PP;LINKAGE=B

 $f_2(1950)$ MASS

NODE=M135M

NODE=M135M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1936 ± 12 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.			
1940 ± 50	BAI	00A	BES $J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
1980 ± 22	¹ BARBERIS	00C	450 $pp \rightarrow pp4\pi$
1940 ± 22	² BARBERIS	00C	450 $pp \rightarrow pp2\pi2\pi^0$
1960 ± 30	BARBERIS	97B	OMEG $450 pp \rightarrow pp2(\pi^+ \pi^-)$
1918 ± 12	ANTINORI	95	OMEG $300,450 pp \rightarrow pp2(\pi^+ \pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2038^{+13+12}_{-11-73}	³ UEHARA	09	BELL $10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1930 ± 25	⁴ BINON	05	GAMS $33 \pi^- p \rightarrow \eta \eta n$
1980 ± 2 ± 14	ABE	04	BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
2010 ± 25	ANISOVICH	00J	SPEC
1980 ± 50	ANISOVICH	99B	SPEC $1.35-1.94 p\bar{p} \rightarrow \eta \eta \pi^0$
~ 1990	⁵ OAKDEN	94	RVUE $0.36-1.55 \bar{p}p \rightarrow \pi\pi$
1950 ± 15	⁶ ASTON	91	LASS $11 K^- p \rightarrow \Lambda K \bar{K} \pi \pi$
¹ Decaying into $\pi^+ \pi^- 2\pi^0$.			
² Decaying into $2(\pi^+ \pi^-)$.			
³ Taking into account $f_4(2050)$.			
⁴ First solution, PWA is ambiguous.			
⁵ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.			
⁶ Cannot determine spin to be 2.			

OCCUR=2

NODE=M135M;LINKAGE=A4

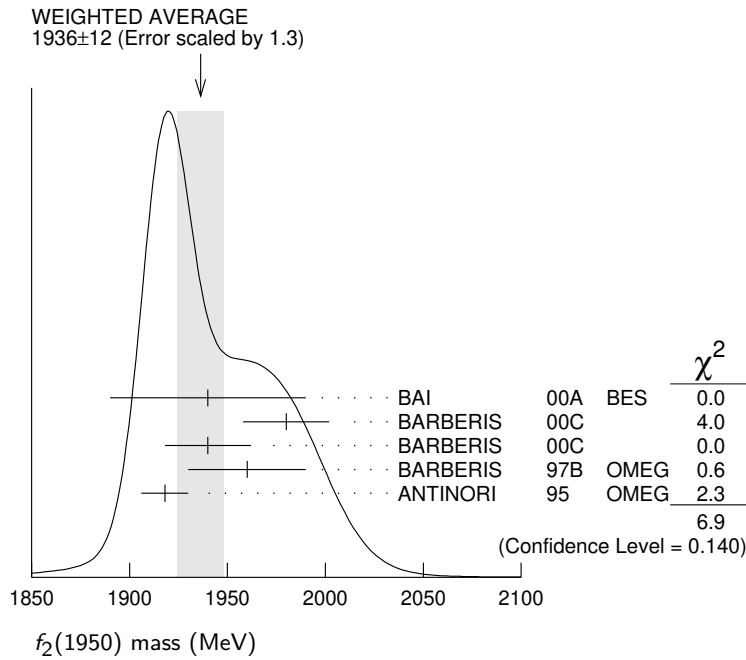
NODE=M135M;LINKAGE=B4

NODE=M135M;LINKAGE=UE

NODE=M135M;LINKAGE=BI

NODE=M135M;LINKAGE=BB

NODE=M135M;LINKAGE=A



f₂(1950) WIDTH

NODE=M135W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
464 ± 24 OUR AVERAGE			
380 ⁺¹²⁰ ₋₉₀	BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
520 ± 50	¹ BARBERIS	00C	450 $pp \rightarrow pp4\pi$
485 ± 55	² BARBERIS	00C	450 $pp \rightarrow pp4\pi$
460 ± 40	BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
390 ± 60	ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
441 ⁺²⁷⁺²⁸ ₋₂₅₋₁₉₂	³ UEHARA	09 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
450 ± 50	⁴ BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
297 ± 12 ± 6	ABE	04 BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
495 ± 35	ANISOVICH	00J SPEC	
500 ± 100	ANISOVICH	99B SPEC	1.35-1.94 $p\bar{p} \rightarrow \eta\eta\pi^0$
~ 100	⁵ OAKDEN	94 RVUE	0.36-1.55 $\bar{p}p \rightarrow \pi\pi$
250 ± 50	⁶ ASTON	91 LASS	11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$

NODE=M135W

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

- ¹Decaying into $\pi^+\pi^-2\pi^0$.
- ²Decaying into $2(\pi^+\pi^-)$.
- ³Taking into account $f_4(2050)$.
- ⁴First solution, PWA is ambiguous.
- ⁵From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- ⁶Cannot determine spin to be 2.

NODE=M135W;LINKAGE=A4
 NODE=M135W;LINKAGE=B4
 NODE=M135W;LINKAGE=UE
 NODE=M135W;LINKAGE=BI
 NODE=M135W;LINKAGE=BB

NODE=M135W;LINKAGE=A

f₂(1950) DECAY MODES

NODE=M135215;NODE=M135

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\bar{K}^*(892)$	seen
Γ_2 $\pi\pi$	
Γ_3 $\pi^+\pi^-$	seen
Γ_4 $\pi^0\pi^0$	seen
Γ_5 4π	seen
Γ_6 $\pi^+\pi^-\pi^+\pi^-$	
Γ_7 $a_2(1320)\pi$	
Γ_8 $\eta\eta$	seen
Γ_9 $K\bar{K}$	seen
Γ_{10} $\gamma\gamma$	seen
Γ_{11} $p\bar{p}$	seen

DESIG=1
 DESIG=11
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=4
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=12

$f_2(1950) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M135225

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_9\Gamma_{10}/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M135G1
NODE=M135G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$122 \pm 4 \pm 26$	¹ ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
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¹ Assuming spin 2.

NODE=M135G1;LINKAGE=AB

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{10}/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M135G2
NODE=M135G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$162^{+69+1137}_{-42-204}$	¹ UEHARA	09	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
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¹ Taking into account $f_4(2050)$.

NODE=M135G2;LINKAGE=UE

 $f_2(1950)$ BRANCHING RATIOS

NODE=M135220

 $\Gamma(K^*(892)\bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M135R1
NODE=M135R1

seen	ASTON	91	LASS 0	11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$
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 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M135R3
NODE=M135R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
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not seen	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
----------	----------	-----	-----------------------------------

possibly seen	BARBERIS	97B	OMEG 450 $pp \rightarrow pp2(\pi^+ \pi^-)$
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 $\Gamma(\eta\eta)/\Gamma(4\pi)$ Γ_8/Γ_5

VALUE	CL%	DOCUMENT ID	COMMENT
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NODE=M135R5
NODE=M135R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 5.0 \times 10^{-3}$	90	BARBERIS	00E 450 $pp \rightarrow p_f \eta \eta p_s$
------------------------	----	----------	--

 $\Gamma(\eta\eta)/\Gamma(\pi^+\pi^-)$ Γ_8/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M135R6
NODE=M135R6

0.14 ± 0.05	AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
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 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M135R07
NODE=M135R07

seen	111	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$
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 $f_2(1950)$ REFERENCES

NODE=M135

RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47426
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47958
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>		REFID=46886
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=44437
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ASTON	91	NPBPS B21 5	D. Aston <i>et al.</i>	(LASS Collab.)	REFID=41746
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355

$a_4(1970)$

$I^G(J^{PC}) = 1^-(4^{++})$

NODE=M017

$a_4(1970)$ MASS

NODE=M017M

NODE=M017M

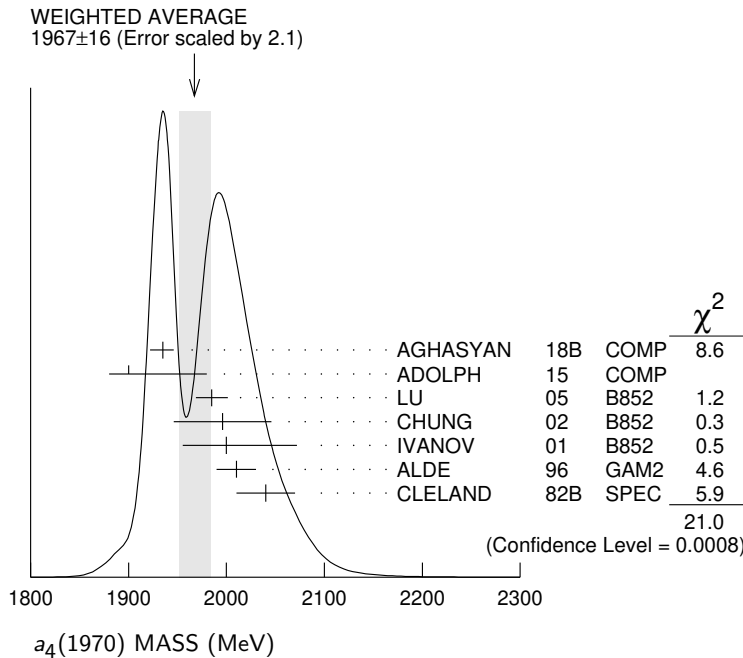
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1967±16 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.					
1935 ⁺¹¹ ₋₁₃	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1900 ⁺⁸⁰ ₋₂₀		ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1985±10±13	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1996±25±43		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$
2000±40 ⁺⁶⁰ ₋₂₀		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
2010±20		² ALDE	96	GAM2 0	38 $\pi^- p \rightarrow \eta \pi^0 n$
2040±30		³ CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1885±13 ⁺⁵⁰ ₋₂	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
2004±6	80k	⁵ UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2005 ⁺²⁵ ₋₄₅		⁶ ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
1944±8±50		⁷ AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
1903±10		⁸ BALDI	78	SPEC -	10 $\pi^- p \rightarrow p K_S^0 K^-$
2030±50		⁹ CORDEN	78C	OMEG 0	15 $\pi^- p \rightarrow 3\pi n$

- ¹ Statistical error negligible.
- ² From a simultaneous fit to the G_+ and G_0 wave intensities.
- ³ From an amplitude analysis.
- ⁴ Superseded by AGHASYAN 2018B.
- ⁵ Statistical error only.
- ⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.
- ⁷ May be a different state.
- ⁸ From a fit to the Y_8^0 moment. Limited by phase space.
- ⁹ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

NODE=M017M;LINKAGE=B
 NODE=M017M;LINKAGE=A
 NODE=M017M;LINKAGE=C
 NODE=M017M;LINKAGE=D
 NODE=M017M;LINKAGE=ST
 NODE=M017M;LINKAGE=AN
 NODE=M017M;LINKAGE=DM
 NODE=M017M;LINKAGE=Y
 NODE=M017M;LINKAGE=M



$a_4(1970)$ WIDTH

NODE=M017W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
324⁺¹⁵₋₁₈ OUR AVERAGE					
333 ⁺¹⁶ ₋₂₁	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
300 ⁺⁸⁰ ₋₁₀₀		ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
231 \pm 30 \pm 46	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
298 \pm 81 \pm 85		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$
350 \pm 100 ⁺⁷⁰ ₋₅₀		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
370 \pm 80		² ALDE	96	GAM2 0	38 $\pi^- p \rightarrow \eta \pi^0 n$
380 \pm 150		³ CLELAND	82B	SPEC \pm	50 $\pi p \rightarrow K_S^0 K^\pm p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

294 \pm 25 ⁺⁴⁶ ₋₁₉	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ P_b'$
401 \pm 16	80k	⁵ UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
180 \pm 30		⁶ ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
324 \pm 26 \pm 75		⁷ AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
166 \pm 43		⁸ BALDI	78	SPEC $-$	10 $\pi^- p \rightarrow p K_S^0 K^-$
510 \pm 200		⁹ CORDEN	78C	OMEG 0	15 $\pi^- p \rightarrow 3\pi n$

¹ Statistical error negligible.

² From a simultaneous fit to the G_+ and G_0 wave intensities.

³ From an amplitude analysis.

⁴ Superseded by AGHASYAN 2018B.

⁵ Statistical error only.

⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

⁷ May be a different state.

⁸ From a fit to the Y_8^0 moment. Limited by phase space.

⁹ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

NODE=M017W

NODE=M017W;LINKAGE=B
 NODE=M017W;LINKAGE=A
 NODE=M017W;LINKAGE=C
 NODE=M017W;LINKAGE=D
 NODE=M017W;LINKAGE=ST
 NODE=M017W;LINKAGE=AN
 NODE=M017W;LINKAGE=DM
 NODE=M017W;LINKAGE=Y
 NODE=M017W;LINKAGE=M

$a_4(1970)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $\pi^+ \pi^- \pi^0$	seen
Γ_3 $\rho \pi$	seen
Γ_4 $f_2(1270) \pi$	seen
Γ_5 $\omega \pi^- \pi^0$	seen
Γ_6 $\omega \rho$	seen
Γ_7 $\eta \pi$	seen
Γ_8 $\eta'(958) \pi$	seen

NODE=M017215;NODE=M017

DESIG=1
 DESIG=2
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=8
 DESIG=3
 DESIG=4;OUR EST;→ UNCHECKED ←

$a_4(1970)$ BRANCHING RATIOS

$\Gamma(K \bar{K})/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	BALDI	78	SPEC \pm	10 $\pi^- p \rightarrow K_S^0 K^- p$
$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$	Γ_2/Γ			
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	CORDEN	78C	OMEG 0	15 $\pi^- p \rightarrow 3\pi n$
$\Gamma(\rho \pi)/\Gamma(f_2(1270) \pi)$	Γ_3/Γ_4			
VALUE	DOCUMENT ID	TECN	COMMENT	

NODE=M017220

NODE=M017R1
 NODE=M017R1

NODE=M017R2
 NODE=M017R2

NODE=M017R4
 NODE=M017R4

1.7^{+0.9}_{-0.8} OUR AVERAGE Error includes scale factor of 3.7.

2.9 ^{+0.6} _{-0.4}	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1.1 \pm 0.2 \pm 0.2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$

¹ Statistical error negligible.

NODE=M017R4;LINKAGE=A

$\Gamma(\eta\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ
seen	ALDE	96	GAM2	0	$38 \pi^- p \rightarrow \eta \pi^0 n$

NODE=M017R3
 NODE=M017R3

 $\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ_7
0.23±0.07	ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$

NODE=M017R01
 NODE=M017R01

 $\Gamma(\omega\rho)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
seen	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$

NODE=M017R5
 NODE=M017R5

 $a_4(1970)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59471
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56385
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)	REFID=50459
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>		REFID=48352
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48317
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=46910
		Translated from YAF 62 487.			
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>		REFID=46903
ANISOVICH	99E	PL B452 187	A.V. Anisovich <i>et al.</i>		REFID=46902
ALDE	96	PAN 59 982	S.V. Donskov <i>et al.</i>	(GAMS Collab.) IGJPC	REFID=45207
		Translated from YAF 59 1027.			
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
BALDI	78	PL 74B 413	R. Baldi <i>et al.</i>	(GEVA) JP	REFID=21783
CORDEN	78C	NP B136 77	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20859

NODE=M017

 $\rho_3(1990)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

OMITTED FROM SUMMARY TABLE

NODE=M167

 $\rho_3(1990)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

1982±14	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2007	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167M

NODE=M167M

NODE=M167M;LINKAGE=AY

 $\rho_3(1990)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

188±24	² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 287	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$

² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167W

NODE=M167W

NODE=M167W;LINKAGE=AY

 $\rho_3(1990)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>		REFID=48828
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>		REFID=48327
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>		REFID=48349
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103

NODE=M167

$\pi_2(2005)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M239

OMITTED FROM SUMMARY TABLE

 $\pi_2(2005)$ MASS

NODE=M239M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1963⁺¹⁷₋₂₇ OUR AVERAGE				
1962 ⁺¹⁷ ₋₂₉	46M	¹ AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1974 ± 14 ± 83	145k	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2005 ± 15		ANISOVICH	01F SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
¹ Statistical uncertainty negligible.				

NODE=M239M

NODE=M239M;LINKAGE=A

 $\pi_2(2005)$ WIDTH

NODE=M239W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
370⁺¹⁶₋₉₀ OUR AVERAGE				
371 ⁺¹⁶ ₋₁₂₀	46M	¹ AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
341 ± 61 ± 139	145k	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200 ± 40		ANISOVICH	01F SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
¹ Statistical uncertainty negligible.				

NODE=M239W

NODE=M239W;LINKAGE=A

 $\pi_2(2005)$ DECAY MODES

NODE=M239215;NODE=M239

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^- \pi^+ \pi^-$	seen
Γ_2 $\omega \pi^0 \pi^-$	seen

DESIG=1

DESIG=2

 $\pi_2(2005)$ BRANCHING RATIOS

NODE=M239220

$\Gamma(\pi^- \pi^+ \pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$\Gamma(\omega \pi^0 \pi^-)/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$

NODE=M239R00
NODE=M239R00NODE=M239R01
NODE=M239R01 $\pi_2(2005)$ REFERENCES

NODE=M239

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59471
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)	REFID=50459
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>		REFID=48352

$f_2(2010)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M106

 $f_2(2010)$ MASS

NODE=M106M

NODE=M106M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2011^{+62}_{-76}	¹ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
$2062 \pm 6^{+10}_{-7}$	² ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
2005 ± 12	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2049^{+35}_{-24}	³ LONGACRE	04 RVUE	$22 \pi^- p \rightarrow \phi \phi n, 450$ $pp \rightarrow p_f 4\pi p_s$
1980 ± 20	⁴ BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2050^{+90}_{-50}	ETKIN	85 MPS	$22 \pi^- p \rightarrow 2\phi n$
2120^{+20}_{-120}	LINDENBAUM	84 RVUE	
2160 ± 50	ETKIN	82 MPS	$22 \pi^- p \rightarrow 2\phi n$

¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 98^{+1}_{-3} , 0^{+1}_{-0} , and 2^{+2}_{-1} , respectively.

² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

³ From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00C data.

⁴ Statistically very weak, only 1.4 s.d.

NODE=M106M;LINKAGE=C

NODE=M106M;LINKAGE=A

NODE=M106M;LINKAGE=B

NODE=M106M;LINKAGE=E

 $f_2(2010)$ WIDTH

NODE=M106W

NODE=M106W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
202^{+67}_{-62}	⁵ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
$165 \pm 17^{+10}_{-5}$	⁶ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
209 ± 32	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
567^{+64}_{-71}	⁷ LONGACRE	04 RVUE	$22 \pi^- p \rightarrow \phi \phi n, 450$ $pp \rightarrow p_f 4\pi p_s$
145 ± 50	⁸ BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
200^{+160}_{-50}	ETKIN	85 MPS	$22 \pi^- p \rightarrow 2\phi n$
300^{+150}_{-50}	LINDENBAUM	84 RVUE	
310 ± 70	ETKIN	82 MPS	$22 \pi^- p \rightarrow 2\phi n$

⁵ Includes data of ETKIN 85.

⁶ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

⁷ From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00C data

⁸ Statistically very weak, only 1.4 s.d.

NODE=M106W;LINKAGE=C

NODE=M106W;LINKAGE=A

NODE=M106W;LINKAGE=B

NODE=M106W;LINKAGE=E

 $f_2(2010)$ DECAY MODES

NODE=M106215;NODE=M106

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi \phi$	seen
$\Gamma_2 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

 $f_2(2010)$ BRANCHING RATIOS

NODE=M106230

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$	

NODE=M106R01

NODE=M106R01

$f_2(2010)$ REFERENCES

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
LONGACRE	04	PR D70 094041	R.S. Longacre, S.J. Lindenbaum	(BNL, CUNY)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)
ETKIN	82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)
Also		Brighton Conf. 351	S.J. Lindenbaum	(BNL, CUNY)

NODE=M106

REFID=61891
REFID=62033
REFID=51191REFID=50341
REFID=47959
REFID=40580
REFID=40285
REFID=21871
REFID=21869
REFID=21866
REFID=21867 **$f_0(2020)$**

$$I^G(J^{PC}) = 0^+(0^{++})$$

Needs confirmation.

NODE=M156

NODE=M156

 $f_0(2020)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M156PP

NODE=M156PP

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
(1870–2080) – i (120–240) OUR ESTIMATE				
(2038 \pm 48) – i (156 \pm 41)		¹ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
(1925 \pm 25) – i (160 \pm 18)		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
(1910 \pm 50) – i (199 \pm 40)		² ROPERTZ	18 RVUE	$\bar{B}_s^0 \rightarrow J/\psi(\pi^+\pi^-/K^+K^-)$
(1992 \pm 16) – i (221 \pm 30)		³ BARBERIS	00C	450 $pp \rightarrow p\bar{p}4\pi p_S$
(2020 \pm 35) – i (205 \pm 25)		BARBERIS	97B OMEG	450 $pp \rightarrow p\bar{p}2(\pi^+\pi^-)$

NODE=M156PP

→ UNCHECKED ←

¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).

NODE=M156PP;LINKAGE=A

² T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.

NODE=M156PP;LINKAGE=C

³ Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.

NODE=M156PP;LINKAGE=B

 $f_0(2020)$ MASS

NODE=M156M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1982 \pm 3⁺⁵⁴₋₀		¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$
••• We do not use the following data for averages, fits, limits, etc. •••				
2010 \pm 6 ⁺⁶ ₋₄		² ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$
2037 \pm 8	80k	³ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2040 \pm 38		ANISOVICH	00J SPEC	
2010 \pm 60		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0\pi^0 n$

NODE=M156M

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M156M;LINKAGE=C

² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta' P$ -wave.

NODE=M156M;LINKAGE=D

³ Statistical error only.

NODE=M156M;LINKAGE=ST

 $f_0(2020)$ WIDTH

NODE=M156W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
436 \pm 4⁺⁴⁶₋₄₉		¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$
••• We do not use the following data for averages, fits, limits, etc. •••				
203 \pm 9 ⁺¹³ ₋₁₁		² ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$
296 \pm 17	80k	³ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
405 \pm 40		ANISOVICH	00J SPEC	
240 \pm 100		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0\pi^0 n$

NODE=M156W

- ¹ From a partial wave analysis of the systems (γX), with $X \rightarrow \eta' \eta'$, and ($\eta' X$), with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
- ² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.
- ³ Statistical error only.

NODE=M156W;LINKAGE=C

NODE=M156W;LINKAGE=D

NODE=M156W;LINKAGE=ST

NODE=M156215;NODE=M156

 $f_0(2020)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho \pi \pi$	seen
Γ_2 $\pi^0 \pi^0$	seen
Γ_3 $\rho \rho$	seen
Γ_4 $\omega \omega$	seen
Γ_5 $\eta \eta$	seen
Γ_6 $\eta' \eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5

DESIG=6

 $f_0(2020)$ BRANCHING RATIOS

NODE=M156220

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$	DOCUMENT ID	COMMENT	Γ_3/Γ_4
VALUE			

NODE=M156R1
NODE=M156R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 3 BARBERIS 00F 450 $p p \rightarrow p_f \omega \omega p_s$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
VALUE				

NODE=M156R01
NODE=M156R01seen UMAN 06 E835 5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$

$\Gamma(\eta' \eta')/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
VALUE				

NODE=M156R00
NODE=M156R00seen ¹ ABLIKIM 22C BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

- ¹ From a partial wave analysis of the systems (γX), with $X \rightarrow \eta' \eta'$, and ($\eta' X$), with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M156R00;LINKAGE=A

 $f_0(2020)$ REFERENCES

NODE=M156

ABLIKIM 22AS PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also PR D107 079901 (errata)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
ABLIKIM 22C PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61637
RODAS 22 EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
SARANTSEV 21 PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ABLIKIM 18AA PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ROPERTZ 18 EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)	REFID=59332
AAIJ 17V JHEP 1708 037	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57828
ABLIKIM 15AE PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
AAIJ 14BR PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56035
UMAN 06 PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
ANISOVICH 00J PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BARBERIS 00C PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS 00F PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ALDE 98 EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
Translated from YAF 62 446.			
BARBERIS 97B PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758

$f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

NODE=M016

 $f_4(2050)$ MASS

NODE=M016M

NODE=M016M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2018±11 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
1960±15		AMELIN	06 VES	36 $\pi^- p \rightarrow \omega \omega n$
2005±10		¹ BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
1998±15		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2060±20		ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega \omega n$
2038±30		AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2086±15		BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2000±60		ALDE	86D GAM4	100 $\pi^- p \rightarrow n 2 \eta$
2020±20	40k	² BINON	84B GAM2	38 $\pi^- p \rightarrow n 2 \pi^0$
2015±28		³ CASON	82 STRC	8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
2031 ⁺²⁵ ₋₃₆		ETKIN	82B MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
2020±30	700	APEL	75 NICE	40 $\pi^- p \rightarrow n 2 \pi^0$
2050±25		BLUM	75 ASPK	18.4 $\pi^- p \rightarrow n K^+ K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1966±25		⁴ ANISOVICH	09 RVUE	0.0 $\bar{p} p, \pi N$
1885 ⁺¹⁴⁺²¹⁸ ₋₁₃₋₂₅		⁵ UEHARA	09 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2018± 6		ANISOVICH	00J SPEC	2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 2000		⁶ MARTIN	98 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2010		⁷ MARTIN	97 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2040		⁸ OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 1990		⁹ OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
1978± 5		¹⁰ ALPER	80 CNTR	62 $\pi^- p \rightarrow K^+ K^- n$
2040±10		¹⁰ ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p \bar{p} n$
1935±13		¹⁰ CORDEN	79 OMEG	12-15 $\pi^- p \rightarrow n 2 \pi$
1988± 7		EVANGELIS...	79B OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
1922±14		¹¹ ANTIPOV	77 CIBS	25 $\pi^- p \rightarrow p 3 \pi$

OCCUR=2

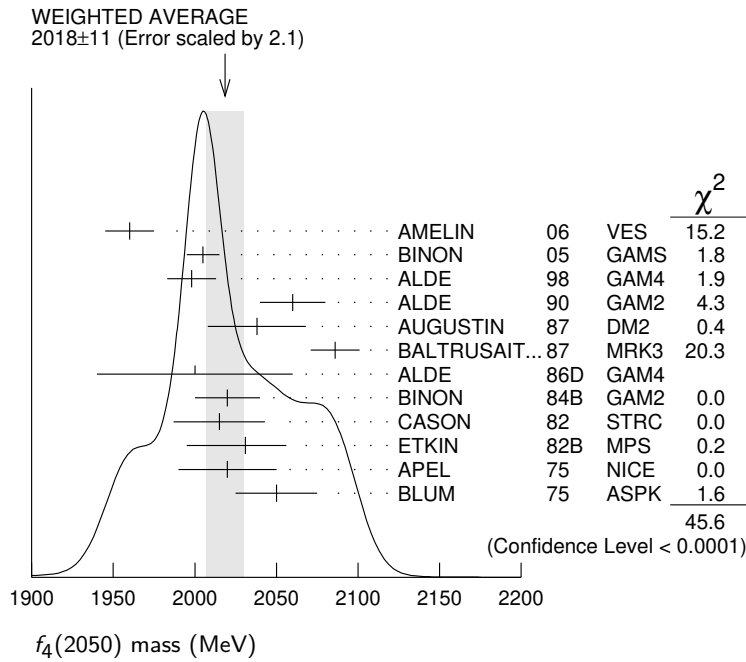
¹ From the first PWA solution.² From a partial-wave analysis of the data.³ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.⁴ K matrix pole.⁵ Taking into account the $f_2(1950)$. Helicity-2 production favored.⁶ Energy-dependent analysis.⁷ Single energy analysis.⁸ From solution A of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.⁹ From solution B of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016M;LINKAGE=BI
 NODE=M016M;LINKAGE=N
 NODE=M016M;LINKAGE=NN
 NODE=M016M;LINKAGE=KM
 NODE=M016M;LINKAGE=UE
 NODE=M016M;LINKAGE=RB
 NODE=M016M;LINKAGE=BR
 NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M

NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
237± 18 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
290± 20		AMELIN	06	VES 36 $\pi^- p \rightarrow \omega \omega n$
340± 80		12 BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
395± 40		ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
170± 60		ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega \omega n$
304± 60		AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
210± 63		BALTRUSAIT..	87	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
400±100		ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2 \eta$
240± 40	40k	13 BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2 \pi^0$
190± 14		DENNEY	83	LASS 10 $\pi^+ n/\pi^+ p$
186 ⁺¹⁰³ ₋₅₈		14 CASON	82	STRC 8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
305 ⁺³⁶ ₋₁₁₉		ETKIN	82B	MPS 23 $\pi^- p \rightarrow n 2 K_S^0$
180± 60	700	APEL	75	NICE 40 $\pi^- p \rightarrow n 2 \pi^0$
225 ⁺¹²⁰ ₋₇₀		BLUM	75	ASPK 18.4 $\pi^- p \rightarrow n K^+ K^-$

NODE=M016W

- • • We do not use the following data for averages, fits, limits, etc. • • •
- 260± 40 15 ANISOVICH 09 RVUE 0.0 $\bar{p} p, \pi N$
- 453± 20⁺³¹₋₁₂₉ 16 UEHARA 09 BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
- 182± 7 ANISOVICH 00J SPEC 2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$
 $\eta \eta, \eta \eta', \pi \pi$
- ~ 170 17 MARTIN 98 RVUE $N \bar{N} \rightarrow \pi \pi$
- ~ 200 18 MARTIN 97 RVUE $\bar{N} N \rightarrow \pi \pi$
- ~ 60 19 OAKDEN 94 RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
- ~ 80 20 OAKDEN 94 RVUE 0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
- 243± 16 21 ALPER 80 CNTR 62 $\pi^- p \rightarrow K^+ K^- n$
- 140± 15 21 ROZANSKA 80 SPRK 18 $\pi^- p \rightarrow p \bar{p} n$
- 263± 57 21 CORDEN 79 OMEG 12-15 $\pi^- p \rightarrow n 2 \pi$
- 100± 28 EVANGELIS... 79B OMEG 10 $\pi^- p \rightarrow K^+ K^- n$
- 107± 56 22 ANTIPOV 77 CIBS 25 $\pi^- p \rightarrow p 3 \pi$

OCCUR=2

12 From the first PWA solution.
 13 From a partial-wave analysis of the data.
 14 From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.
 15 K matrix pole.
 16 Taking into account the $f_2(1950)$. Helicity-2 production favored.
 17 Energy-dependent analysis.
 18 Single energy analysis.

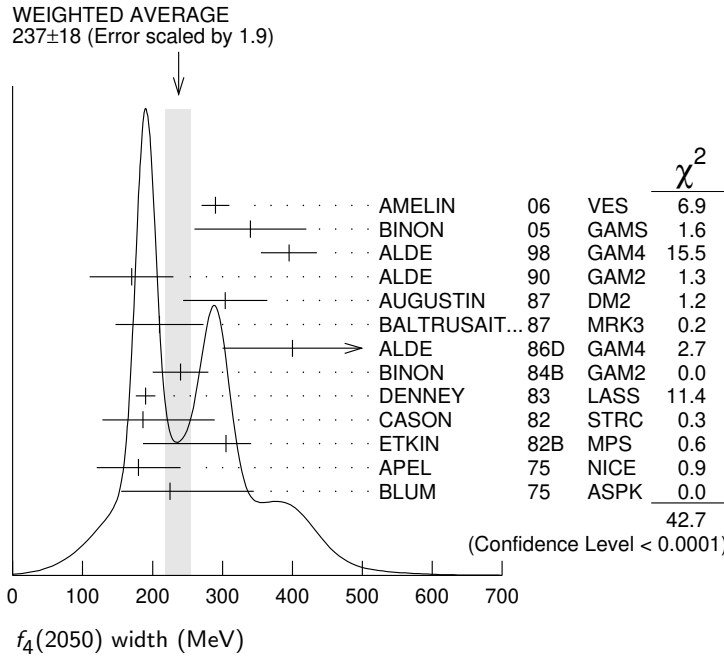
NODE=M016W;LINKAGE=BI
 NODE=M016W;LINKAGE=N
 NODE=M016W;LINKAGE=NN
 NODE=M016W;LINKAGE=KM
 NODE=M016W;LINKAGE=UE
 NODE=M016W;LINKAGE=RB
 NODE=M016W;LINKAGE=BR

- 19 From solution A of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 20 From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 21 $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.
- 22 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016W;LINKAGE=BW

NODE=M016W;LINKAGE=BB

NODE=M016W;LINKAGE=M
NODE=M016W;LINKAGE=T



$f_4(2050)$ DECAY MODES

NODE=M016215;NODE=M016

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega\omega$	seen
Γ_2 $\pi\pi$	(17.0±1.5) %
Γ_3 $K\bar{K}$	(6.8 ^{+3.4} _{-1.8}) × 10 ⁻³
Γ_4 $\eta\eta$	(2.1±0.8) × 10 ⁻³
Γ_5 $4\pi^0$	< 1.2 %
Γ_6 $\gamma\gamma$	seen
Γ_7 $a_2(1320)\pi$	seen

DESIG=6
DESIG=1
DESIG=2
DESIG=3
DESIG=5
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=7

$f_4(2050)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M016220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_6/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
••• We do not use the following data for averages, fits, limits, etc. •••				
<0.29	95	ALTHOFF	85B TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

NODE=M016G2
NODE=M016G2

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_6/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
••• We do not use the following data for averages, fits, limits, etc. •••					
23.1 ^{+3.6+70.5} _{-3.3-15.6}			23 UEHARA	09 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
<1100	95	13 ± 4	OEST	90 JADE	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$

NODE=M016G3
NODE=M016G3

²³ Taking into account the $f_2(1950)$. Helicity-2 production favored.

NODE=M016G3;LINKAGE=UE

$f_4(2050)$ BRANCHING RATIOS

NODE=M016225

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AMELIN	06 VES	36 $\pi^-p \rightarrow \omega\omega n$
••• We do not use the following data for averages, fits, limits, etc. •••			
not seen	BARBERIS	00F	450 $pp \rightarrow pf\omega\omega p_S$

NODE=M016R7
NODE=M016R7

$\Gamma(\omega\omega)/\Gamma(\pi\pi)$				Γ_1/Γ_2	
VALUE	DOCUMENT ID	TECN	COMMENT		
1.5±0.3	ALDE	90	GAM2 38 $\pi^- p \rightarrow \omega\omega n$		NODE=M016R5 NODE=M016R5
$\Gamma(\pi\pi)/\Gamma_{total}$				Γ_2/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
0.170±0.015 OUR AVERAGE					NODE=M016R1 NODE=M016R1
0.18 ±0.03	24 BINON	83C	GAM2 38 $\pi^- p \rightarrow n4\gamma$		
0.16 ±0.03	24 CASON	82	STRC 8 $\pi^+ p \rightarrow \Delta^{++}\pi^0\pi^0$		
0.17 ±0.02	24 CORDEN	79	OMEG 12-15 $\pi^- p \rightarrow n2\pi$		
²⁴ Assuming one pion exchange.					NODE=M016R1;LINKAGE=A
$\Gamma(K\bar{K})/\Gamma(\pi\pi)$				Γ_3/Γ_2	
VALUE	DOCUMENT ID	TECN	COMMENT		
0.04^{+0.02}_{-0.01}	ETKIN	82B	MPS 23 $\pi^- p \rightarrow n2K_S^0$		NODE=M016R2 NODE=M016R2
$\Gamma(\eta\eta)/\Gamma_{total}$				Γ_4/Γ	
VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT		
2.1±0.8	ALDE	86D	GAM4 100 $\pi^- p \rightarrow n4\gamma$		NODE=M016R3 NODE=M016R3
$\Gamma(4\pi^0)/\Gamma_{total}$				Γ_5/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
<0.012	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$		NODE=M016R4 NODE=M016R4
$\Gamma(a_2(1320)\pi)/\Gamma_{total}$				Γ_7/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$		NODE=M016R6 NODE=M016R6

f₄(2050) REFERENCES

					NODE=M016
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
MARTIN	98	PR C57 3492	B.R. Martin <i>et al.</i>		REFID=46373
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)	REFID=45685
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)	REFID=21780
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)	REFID=40288
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21665
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	REFID=21774
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21967
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP	REFID=21651

$\pi_2(2100)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M020

NODE=M020

NODE=M020M

NODE=M020M

NODE=M020M;LINKAGE=AX
NODE=M020M;LINKAGE=L

NODE=M020W

NODE=M020W

NODE=M020W;LINKAGE=AX
NODE=M020W;LINKAGE=L

NODE=M020215;NODE=M020

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

NODE=M020220

NODE=M020R1
NODE=M020R1NODE=M020R2
NODE=M020R2NODE=M020R3
NODE=M020R3NODE=M020R4
NODE=M020R4

NODE=M020R;LINKAGE=L

NODE=M020

REFID=44433
REFID=20872 **$\pi_2(2100)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2090± 29 OUR AVERAGE			
2090± 30	¹ AMELIN	95B VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
2100±150	² DAUM	81B CNTR	63,94 $\pi^- p \rightarrow 3\pi X$
¹ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
² From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
620± 50 OUR AVERAGE	Error includes scale factor of 1.2.		
520±100	³ AMELIN	95B VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
651± 50	⁴ DAUM	81B CNTR	63,94 $\pi^- p \rightarrow 3\pi X$
³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
⁴ From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 3π	seen
Γ_2 $\rho\pi$	seen
Γ_3 $f_2(1270)\pi$	seen
Γ_4 $(\pi\pi)_S\pi$	seen

 $\pi_2(2100)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma(3\pi)$	Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.19±0.05	⁵ DAUM	81B CNTR	63,94 $\pi^- p$
$\Gamma(f_2(1270)\pi)/\Gamma(3\pi)$	Γ_3/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.36±0.09	⁵ DAUM	81B CNTR	63,94 $\pi^- p$
$\Gamma((\pi\pi)_S\pi)/\Gamma(3\pi)$	Γ_4/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.45±0.07	⁵ DAUM	81B CNTR	63,94 $\pi^- p$
D-wave/S-wave RATIO FOR $\pi_2(2100) \rightarrow f_2(1270)\pi$			
VALUE	DOCUMENT ID	TECN	COMMENT
0.39±0.23	⁵ DAUM	81B CNTR	63,94 $\pi^- p$
⁵ From a two-resonance fit to four 2^-0^+ waves.			

 $\pi_2(2100)$ REFERENCES

AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

$f_0(2100)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M168

NODE=M168

NODE=M168M

NODE=M168M

 $f_0(2100)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2095⁺¹⁷₋₁₉ OUR AVERAGE				
2116±27±17		LEES	21A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
2081±13 ⁺²⁴ ₋₃₆	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2090±30		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2075±20		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
2090±10±6	529	^{2,3} DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2099±17±8	283	^{2,3} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
2105±8	80k	⁴ UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
2102±13		⁵ ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0, \eta \eta, \eta \eta', \pi^+ \pi^-$
2105±10		ANISOVICH	99K SPEC	$0.6-1.94 \bar{p} p \rightarrow \eta \eta, \eta \eta'$
~ 2104		BUGG	95	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
~ 2122		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

OCCUR=2

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.² Using CLEO-c data but not authored by the CLEO Collaboration.³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 209$ MeV.⁴ Statistical error only.⁵ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

NODE=M168M;LINKAGE=A

NODE=M168M;LINKAGE=B

NODE=M168M;LINKAGE=C

NODE=M168M;LINKAGE=ST

NODE=M168M;LINKAGE=AN

 $f_0(2100)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
287⁺³²₋₂₄ OUR AVERAGE				
289±34±15		LEES	21A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
273 ⁺²⁷ ₋₂₄ ±70 ₋₂₃	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
330±100		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
260±25		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
236±14	80k	² UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
211±29		³ ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0, \eta \eta, \eta \eta', \pi^+ \pi^-$
200±25		ANISOVICH	99K SPEC	$0.6-1.94 \bar{p} p \rightarrow \eta \eta, \eta \eta'$
~ 203		BUGG	95	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
~ 273		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.² Statistical error only.³ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

NODE=M168W

NODE=M168W

NODE=M168W;LINKAGE=A

NODE=M168W;LINKAGE=ST

NODE=M168W;LINKAGE=AN

 $f_0(2100)$ REFERENCES

LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61442
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>		REFID=47942
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47426
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>		REFID=47472
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103

NODE=M168

$f_2(2150)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

This entry was previously called T_0 .

NODE=M042

NODE=M042

NODE=M042205

NODE=M042M
NODE=M042MNODE=M042M;LINKAGE=ST
NODE=M042M;LINKAGE=ANODE=M042M3
NODE=M042M3NODE=M042M3;LINKAGE=K3
NODE=M042M3;LINKAGE=ANODE=M042M4
NODE=M042M4

NODE=M042M4;LINKAGE=AD

NODE=M042M1
NODE=M042M1

OCCUR=2

NODE=M042M1;LINKAGE=B

NODE=M042M1;LINKAGE=BB
NODE=M042M1;LINKAGE=P
NODE=M042M1;LINKAGE=LNODE=M042M2
NODE=M042M2NODE=M042M2;LINKAGE=I
NODE=M042M2;LINKAGE=E
NODE=M042M2;LINKAGE=M

$f_2(2150)$ MASS

$f_2(2150)$ MASS, COMBINED MODES (MeV)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2157±12 OUR AVERAGE Includes data from the datablock that follows this one.					
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2170±6	80k	¹ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$	
2123 ⁺¹⁵ ₋₃₃		² LONGACRE	04 RVUE	22 $\pi^- p \rightarrow \phi\phi n$, 450 $\bar{p}p \rightarrow p_f 4\pi p_S$	
¹ Statistical error only.					
² From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00C data.					
$\eta\eta$ MODE					
VALUE (MeV)		DOCUMENT ID	TECN	COMMENT	
The data in this block is included in the average printed for a previous datablock.					
2157±12 OUR AVERAGE					
2151±16		BARBERIS	00E	450 $\bar{p}p \rightarrow p_f \eta\eta p_S$	
2175±20		PROKOSHKIN	95D GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $\bar{p}p \rightarrow p p 2\eta$	
2130±35		SINGOVSKI	94 GAM4	450 $\bar{p}p \rightarrow p p 2\eta$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2140±30		³ ABELE	99B CBAR	1.94 $\bar{p}p \rightarrow \pi^0 \eta\eta$	
2104±20		⁴ ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0 \eta\eta \rightarrow 6\gamma$	
³ Spin not determined.					
⁴ No J^{PC} determination.					
$\eta\pi\pi$ MODE					
VALUE (MeV)		DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2135±20±45		⁵ ADOMEIT	96 CBAR	0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
⁵ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.					
$\bar{p}p \rightarrow \pi\pi$					
VALUE (MeV)		DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 2090		⁶ OAKDEN	94 RVUE		0.36-1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2120		⁷ OAKDEN	94 RVUE		0.36-1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2170		⁸ MARTIN	80B RVUE		
~ 2150		⁸ MARTIN	80C RVUE		
~ 2150		⁹ DULUDE	78B OSPK		1-2 $\bar{p}p \rightarrow \pi^0 \pi^0$
⁶ OAKDEN 94 makes an amplitude analysis of LEAR data on $\bar{p}p \rightarrow \pi\pi$ using a method based on Barrelet zeros. This is solution A. The amplitude analysis of HASAN 94 includes earlier data as well, and assume that the data can be parametrized in terms of towers of nearly degenerate resonances on the leading Regge trajectory. See also KLOET 96 and MARTIN 97 who make related analyses.					
⁷ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$.					
⁸ $I(J^P) = 0(2^+)$ from simultaneous analysis of $\bar{p}p \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.					
⁹ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.					
S-CHANNEL $\bar{p}p$, $\bar{N}N$ or $\bar{K}K$					
VALUE (MeV)		DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2139 ⁺⁸ ₋₉		¹⁰ EVANGELIS...	97 SPEC		0.6-2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
~ 2190		¹⁰ CUTTS	78B CNTR		0.97-3 $\bar{p}p \rightarrow \bar{N}N$
2155±15		^{10,11} COUPLAND	77 CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
2193±2		^{10,12} ALSPECTOR	73 CNTR		$\bar{p}p$ S channel
¹⁰ Isospins 0 and 1 not separated.					
¹¹ From a fit to the total elastic cross section.					
¹² Referred to as T or T region by ALSPECTOR 73.					

$K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2200 ± 13	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2150 ± 20	ABLIKIM	04E	$J/\psi \rightarrow \omega K^+ K^-$
2130 ± 35	BARBERIS	99	$450 p p \rightarrow p_s p_f K^+ K^-$

NODE=M042M5
NODE=M042M5

• • • We do not use the following data for averages, fits, limits, etc. • • •

$f_2(2150)$ WIDTH

NODE=M042210

$f_2(2150)$ WIDTH, COMBINED MODES (MeV)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M042W
NODE=M042W

152 ± 30 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.4. See the ideogram below.

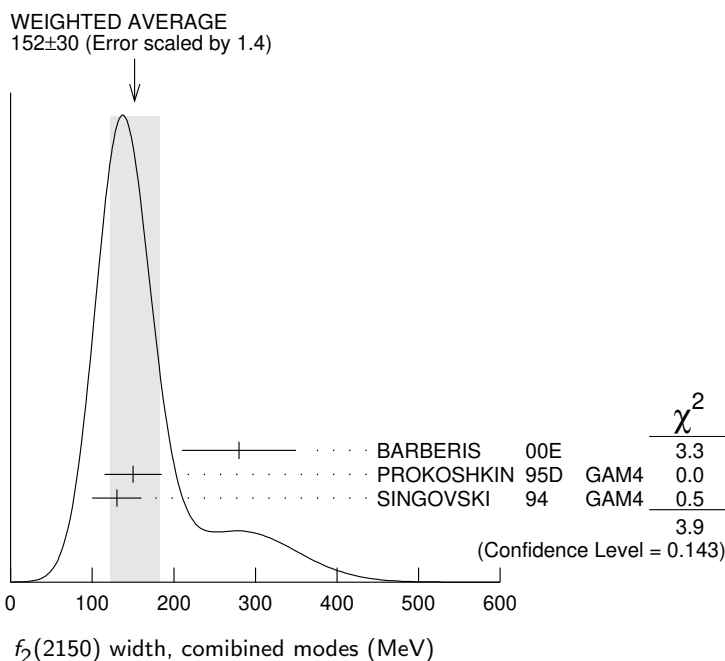
• • • We do not use the following data for averages, fits, limits, etc. • • •

182 ± 11	80k	¹³ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
294^{+56}_{-55}		¹⁴ LONGACRE	04	RVUE	$22 \pi^- p \rightarrow \phi \phi n, 450$ $p p \rightarrow p_f 4 \pi p_s$

¹³ Statistical error only.

¹⁴ From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00c data.

NODE=M042W;LINKAGE=ST
NODE=M042W;LINKAGE=A



$\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M042W3
NODE=M042W3

The data in this block is included in the average printed for a previous datablock.

152 ± 30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

280 ± 70	BARBERIS	00E	$450 p p \rightarrow p_f \eta \eta p_s$
150 ± 35	PROKOSHKIN	95D	$300 \pi^- N \rightarrow \pi^- N 2 \eta,$ $450 p p \rightarrow p p 2 \eta$
130 ± 30	SINGOVSKI	94	$450 p p \rightarrow p p 2 \eta$

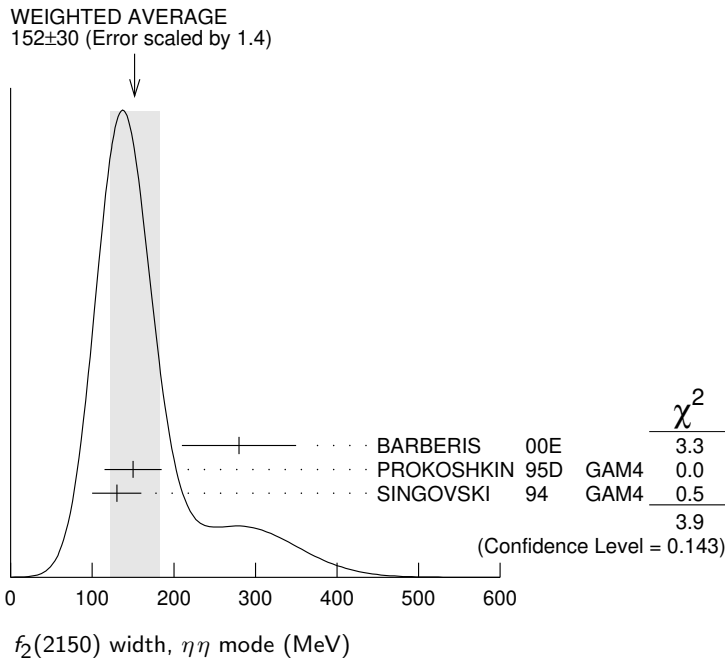
• • • We do not use the following data for averages, fits, limits, etc. • • •

310 ± 50	¹⁵ ABELE	99B	$1.94 \bar{p} p \rightarrow \pi^0 \eta \eta$
203 ± 10	¹⁶ ARMSTRONG	93C	$E760 \bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6 \gamma$

¹⁵ Spin not determined.

¹⁶ No J^{PC} determination.

NODE=M042W3;LINKAGE=K3
NODE=M042W3;LINKAGE=A



ηππ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

250±25±45	17	ADOMEIT	96	CBAR	0	1.94	$\bar{p}p \rightarrow \eta 3\pi^0$
¹⁷ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.							

NODE=M042W4
NODE=M042W4

NODE=M042W4;LINKAGE=AD

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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250 OUR ESTIMATE

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 70	18	OAKDEN	94	RVUE	0.36-1.55	$\bar{p}p \rightarrow \pi\pi$	
~ 250	19	MARTIN	80B	RVUE			
~ 250	19	MARTIN	80C	RVUE			
~ 250	20	DULUDE	78B	OSPK	1-2	$\bar{p}p \rightarrow \pi^0 \pi^0$	
¹⁸ See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.							
¹⁹ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.							
²⁰ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.							

NODE=M042W1
NODE=M042W1
→ UNCHECKED ←

NODE=M042W1;LINKAGE=CC

NODE=M042W1;LINKAGE=P
NODE=M042W1;LINKAGE=L

S-CHANNEL $\bar{p}p, \bar{N}N$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

56 ⁺³¹ ₋₁₆	21	EVANGELIS...	97	SPEC	0.6-2.4	$\bar{p}p \rightarrow K_S^0 K_S^0$
135±75	22,23	COUPLAND	77	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
98± 8	23	ALSPECTOR	73	CNTR		$\bar{p}p$ S channel

²¹ Isospin 0 and 2 not separated.
²² From a fit to the total elastic cross section.
²³ Isospins 0 and 1 not separated.

NODE=M042W2
NODE=M042W2

NODE=M042W2;LINKAGE=F
NODE=M042W2;LINKAGE=E
NODE=M042W2;LINKAGE=I

K \bar{K} MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

91±62	VLADIMIRSK...06	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$
150±30	ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
270±50	BARBERIS	99	OMEG	450 $p\bar{p} \rightarrow p_S p_f K^+ K^-$

NODE=M042W5
NODE=M042W5

$f_2(2150)$ DECAY MODES

NODE=M042215;NODE=M042

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	
Γ_2 $\phi\phi$	
Γ_3 $\eta\eta$	seen
Γ_4 $K\bar{K}$	seen
Γ_5 $f_2(1270)\eta$	seen
Γ_6 $a_2(1320)\pi$	seen
Γ_7 $\rho\bar{\rho}$	seen

DESIG=1

DESIG=7

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6

 $f_2(2150)$ BRANCHING RATIOS

NODE=M042220

 $\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_4/Γ_3

NODE=M042R1

NODE=M042R1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.28±0.23		BARBERIS	00E	450 $p\rho \rightarrow \rho_f \eta \eta p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.1	95	²⁴ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p\rho \rightarrow \rho p 2\eta$
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²⁴ Using data from ARMSTRONG 89D.

NODE=M042R1;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\eta\eta)$ Γ_1/Γ_3

NODE=M042R2

NODE=M042R2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.33	95	²⁵ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p\rho \rightarrow \rho p 2\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.33	95	²⁵ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $p\rho \rightarrow \rho p 2\eta$
-------	----	------------------------------	------	---

²⁵ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R2;LINKAGE=A

 $\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ Γ_5/Γ_6

NODE=M042R3

NODE=M042R3

VALUE	DOCUMENT ID	TECN	COMMENT
0.79±0.11	²⁶ ADOMEIT 96	CBAR	1.94 $\bar{p}\rho \rightarrow \eta 3\pi^0$

²⁶ Using $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

NODE=M042R3;LINKAGE=A

 $\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=M042R04

NODE=M042R04

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma\rho\bar{\rho}$

 $f_2(2150)$ REFERENCES

NODE=M042

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
	Translated from YAF 69 515.			
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
LONGACRE 04	PR D70 094041	R.S. Longacre, S.J. Lindenbaum	(BNL, CUNY)	REFID=50341
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>		REFID=47945
BARBERIS 00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46904
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
EVANGELIS... 97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)	REFID=45687
MARTIN 97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)	REFID=45685
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45202
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
PROKOSHKIN 95D	PD 40 495	Y.D. Prokoshkin	(SERP) IGJPC	REFID=44647
	Translated from DANS 344 469.			
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
OAKDEN 94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
SINGOVSKI 94	NC A107 1911	A.V. Singovsky	(SERP)	REFID=44648
ARMSTRONG 93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
ARMSTRONG 89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41010
ETKIN 88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=40285
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP	REFID=21838
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP	REFID=21837
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)	REFID=21733
DULUDE 78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP	REFID=21850
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)	REFID=21830
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)	REFID=21813

$\rho(2150)$

$$I^G(J^{PC}) = 1^+(1^-)$$

NODE=M032

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M032

 $\rho(2150)$ MASS

NODE=M032205

 e^+e^- PRODUCED

NODE=M032M3

NODE=M032M3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2044 ± 31 ± 4		¹ ABLIKIM	23BQ BES3	$e^+e^- \rightarrow a_2(1320)^+ \pi^- +$ c.c. $\rightarrow \eta \pi^+ \pi^-$
2095 ± 4		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega \pi^0$
2034 ± 13 ± 9		³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega \pi^0$
2111 ± 43 ± 25		⁴ ABLIKIM	21X BES3	$e^+e^- \rightarrow \eta' \pi^+ \pi^-$
2255 $\begin{smallmatrix} +17 \\ -18 \end{smallmatrix}$ $\begin{smallmatrix} +50 \\ -41 \end{smallmatrix}$	1.8k	⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
2201 ± 19		⁶ LEES	20 BABR	$e^+e^- \rightarrow K^+ K^- \gamma$
2227 ± 9 ± 9		⁷ LEES	20 RVUE	$e^+e^- \rightarrow K^+ K^-$
2039 ± 8 $\begin{smallmatrix} +36 \\ -18 \end{smallmatrix}$		⁸ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
2239.2 ± 7.1 ± 11.3		⁹ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+ K^-$
2254 ± 22		¹⁰ LEES	12G BABR	$e^+e^- \rightarrow \pi^+ \pi^- \gamma$
2150 ± 40 ± 50		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow$ $f_1(1285) \pi^+ \pi^- \gamma$
1990 ± 80		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta' \pi^+ \pi^- \gamma$
2153 ± 37		BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+ \pi^-, K^+ K^-$
2110 ± 50		¹¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+ \pi^-),$ $2(\pi^+ \pi^- \pi^0)$

OCCUR=2

OCCUR=2

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of a Breit-Wigner resonance and a non-resonant contribution. Could be another state.

NODE=M032M3;LINKAGE=J

² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

NODE=M032M3;LINKAGE=K

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. Could be another state.

NODE=M032M3;LINKAGE=G

⁴ From a Breit-Wigner fit to the Born cross section, including an s -dependent continuum amplitude.

NODE=M032M3;LINKAGE=H

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (21.7 \pm 1.9 \begin{smallmatrix} +7.7 \\ -8.3 \end{smallmatrix}) \times 10^{-6}$.

NODE=M032M3;LINKAGE=F

⁶ From the fit to the BABAR data of LEES 13Q assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution. The resonance significance is 3.5σ .

NODE=M032M3;LINKAGE=C

⁷ From the fit to the BABAR data of LEES 13Q and BESIII data of ABLIKIM 19L assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution.

NODE=M032M3;LINKAGE=D

⁸ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X \pi^0 \rightarrow K^+ K^- \pi^0 = (6.7 \pm 1.1 \begin{smallmatrix} +2.2 \\ -1.8 \end{smallmatrix}) \times 10^{-6}$.

NODE=M032M3;LINKAGE=B

⁹ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

NODE=M032M3;LINKAGE=E

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

NODE=M032M3;LINKAGE=LE

¹¹ Includes ATKINSON 85.

NODE=M032M3;LINKAGE=A

 $\bar{p}p \rightarrow \pi\pi$

NODE=M032M1

NODE=M032M1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 2191	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 2070	¹ OAKDEN	94	RVUE $0.36-1.55 \bar{p}p \rightarrow \pi\pi$
~ 2170	² MARTIN	80B	RVUE
~ 2100	² MARTIN	80C	RVUE

¹ See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

NODE=M032M1;LINKAGE=CC

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

NODE=M032M;LINKAGE=P

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2110 ± 35	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	² CUTTS	78B	CNTR 0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{2,3} COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{2,4} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2190 ± 10	⁵ ABRAMS	70	CNTR S channel $\bar{p}N$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

² Isospins 0 and 1 not separated.

³ From a fit to the total elastic cross section.

⁴ Referred to as T or T region by ALSPECTOR 73.

⁵ Seen as bump in $l = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M032M2
NODE=M032M2

NODE=M032M;LINKAGE=AY

NODE=M032M;LINKAGE=I
NODE=M032M;LINKAGE=E
NODE=M032M;LINKAGE=M
NODE=M032M;LINKAGE=B

 $\pi^- p \rightarrow \omega\pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2140 ± 30	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega\pi^0 n$
2170 ± 30	ALDE	92C	GAM4 100 $\pi^- p \rightarrow \omega\pi^0 n$

NODE=M032M4
NODE=M032M4

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $\rho(2150)$ WIDTH

NODE=M032210

 $e^+ e^-$ PRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
163 ± 69 ± 24		¹ ABLIKIM	23BQ BES3	$e^+ e^- \rightarrow a_2(1320)^+ \pi^- +$ c.c. $\rightarrow \eta\pi^+ \pi^-$
270 ± 3		² ACHASOV	23A SND	$e^+ e^- \rightarrow \omega\pi^0$
234 ± 30 ± 25		³ ABLIKIM	21A BES3	$e^+ e^- \rightarrow \omega\pi^0$
135 ± 34 ± 30		⁴ ABLIKIM	21X BES3	$e^+ e^- \rightarrow \eta' \pi^+ \pi^-$
460 $\begin{smallmatrix} + 54 \\ - 48 \end{smallmatrix}$ $\begin{smallmatrix} + 160 \\ - 90 \end{smallmatrix}$	1.8k	⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
70 ± 38		⁶ LEES	20 BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
127 ± 14 ± 4		⁷ LEES	20 RVUE	$e^+ e^- \rightarrow K^+ K^-$
196 ± 23 $\begin{smallmatrix} + 25 \\ - 27 \end{smallmatrix}$		⁸ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
139.8 ± 12.3 ± 20.6		⁹ ABLIKIM	19L BES3	$e^+ e^- \rightarrow K^+ K^-$
109 ± 76		¹⁰ LEES	12G BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
350 ± 40 ± 50		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow$ $f_1(1285) \pi^+ \pi^- \gamma$
310 ± 140		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \eta' \pi^+ \pi^- \gamma$
389 ± 79		BIAGINI	91 RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-, K^+ K^-$
410 ± 100		¹¹ CLEGG	90 RVUE	$e^+ e^- \rightarrow 3(\pi^+ \pi^-),$ $2(\pi^+ \pi^- \pi^0)$

NODE=M032W3
NODE=M032W3

• • • We do not use the following data for averages, fits, limits, etc. • • •

OCCUR=2

OCCUR=2

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of a Breit-Wigner resonance and a non-resonant contribution. Could be another state.

² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. Could be another state.

⁴ From a Breit-Wigner fit to the Born cross section, including an s -dependent continuum amplitude.

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (21.7 \pm 1.9 \begin{smallmatrix} + 7.7 \\ - 8.3 \end{smallmatrix}) \times 10^{-6}$.

⁶ From the fit to the BABAR data of LEES 13Q assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution. The resonance significance is 3.5σ .

⁷ From the fit to the BABAR data of LEES 13Q and BESIII data of ABLIKIM 19L assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution.

⁸ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+ K^- \pi^0 = (6.7 \pm 1.1 \begin{smallmatrix} + 2.2 \\ - 1.8 \end{smallmatrix}) \times 10^{-6}$.

⁹ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

¹¹ Includes ATKINSON 85.

NODE=M032W3;LINKAGE=J

NODE=M032W3;LINKAGE=K

NODE=M032W3;LINKAGE=G

NODE=M032W3;LINKAGE=H

NODE=M032W3;LINKAGE=F

NODE=M032W3;LINKAGE=C

NODE=M032W3;LINKAGE=D

NODE=M032W3;LINKAGE=B

NODE=M032W3;LINKAGE=E

NODE=M032W3;LINKAGE=LE

NODE=M032W3;LINKAGE=A

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 296	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 40	¹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	² MARTIN	80B	RVUE	
~ 200	² MARTIN	80C	RVUE	

¹See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

NODE=M032W1
NODE=M032W1

NODE=M032W1;LINKAGE=CC

NODE=M032W;LINKAGE=P

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

230±50	¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	^{2,3} COUPLAND	77	CNTR	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98±8	³ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	⁴ ABRAMS	70	CNTR	S channel $\bar{p}N$

¹From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

²From a fit to the total elastic cross section.

³Isospins 0 and 1 not separated.

⁴Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M032W2
NODE=M032W2

NODE=M032W;LINKAGE=AY

NODE=M032W;LINKAGE=E

NODE=M032W;LINKAGE=I

NODE=M032W;LINKAGE=B

 $\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

320±70	ALDE	95	GAM2	38 $\pi^-p \rightarrow \omega\pi^0n$
~ 300	ALDE	92C	GAM4	100 $\pi^-p \rightarrow \omega\pi^0n$

NODE=M032W4
NODE=M032W4

 $\rho(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^-$	seen
Γ_3 K^+K^-	seen
Γ_4 $3(\pi^+\pi^-)$	seen
Γ_5 $2(\pi^+\pi^-\pi^0)$	seen
Γ_6 $\eta'\pi^+\pi^-$	seen
Γ_7 $f_1(1285)\pi^+\pi^-$	seen
Γ_8 $\omega\pi^0$	seen
Γ_9 $\omega\pi^0\eta$	seen
Γ_{10} $a_2(1320)\pi$	
Γ_{11} $p\bar{p}$	

NODE=M032215;NODE=M032

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

DESIG=12

DESIG=10

 $\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_6\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

23.3±5.3±3.3	¹ ABLIKIM	21X	BES3	$e^+e^- \rightarrow \eta'\pi^+\pi^-$
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¹From a Breit-Wigner fit to the Born cross section interfering constructively with the continuum. For destructive interference the value is $0.64 \pm 0.49 \pm 0.42$ eV.

NODE=M032220

NODE=M032R02

NODE=M032R02

NODE=M032R02;LINKAGE=A

$\Gamma(\omega\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_8\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

34±11±16	ABLIKIM	21A	BES3	$e^+e^- \rightarrow \omega\pi^0$
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NODE=M032R00

NODE=M032R00

$$\Gamma(a_2(1320)\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{10}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

34.6 ± 17.1 ± 6.0	¹ ABLIKIM	23BQ BES3	$e^+e^- \rightarrow a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$
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¹ From a solution of the fit to the cross section between 2.00 and 3.08 GeV using a coherent sum of a single Breit-Wigner resonance and a non-resonant contribution. $B(a_2(1320) \rightarrow \eta\pi) \times B(\eta \rightarrow \gamma\gamma)$ fixed to 0.057. Another solution with equal fit quality gives $137.1 \pm 73.3 \pm 2.1$ eV.

NODE=M032R04
NODE=M032R04

NODE=M032R04;LINKAGE=A

$$\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M032230

$$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10 ⁻⁷)	DOCUMENT ID	TECN	COMMENT
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3.1 ± 0.6 ± 0.5	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$
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¹ Calculated by us from the reported value of cross section at the peak.

NODE=M032G01
NODE=M032G01

NODE=M032G01;LINKAGE=AU

$$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ± 1.9	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
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¹ Calculated by us from the reported value of cross section at the peak.

NODE=M032G02
NODE=M032G02

NODE=M032G02;LINKAGE=AU

$\rho(2150)$ REFERENCES

NODE=M032

ABLIKIM	23BQ	PR D108 L111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62510
ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=62428
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61028
ABLIKIM	21X	PR D103 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61231
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
LEES	20	PR D101 012011	J.P. Lees <i>et al.</i>	(BESIII Collab.)	REFID=60211
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
ABLIKIM	19L	PR D99 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59612
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58311
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>		REFID=48828
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>		REFID=48327
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>		REFID=48349
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP	REFID=44371
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
BIAGINI	91	NC 104A 363	M.E. Biagini <i>et al.</i>	(FRAS, PRAG)	REFID=41894
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=41355
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=22000
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP	REFID=21838
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP	REFID=21837
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)	REFID=21733
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)	REFID=21830
PEASLEE	75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)	REFID=21824
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)	REFID=21813
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)	REFID=21807
COOPER	68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)	REFID=21805
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

$\phi(2170)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M103

NODE=M103

NODE=M103M

NODE=M103M
NEW $\phi(2170)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2164 ± 5 OUR AVERAGE				
[2164 ± 6 MeV OUR 2024 AVERAGE]				
2164.7 ± 9.1 ± 3.1		¹ ABLIKIM	24AN BES3	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
2178 ± 20 ± 5		² ABLIKIM	23AX BES3	$e^+e^- \rightarrow \phi \pi^+ \pi^-$
2190 ± 19 ± 37		³ ABLIKIM	22L BES3	$2.0-3.08 e^+e^- \rightarrow K^+ K^- \pi^0$
2163.5 ± 6.2 ± 3.0		⁴ ABLIKIM	21T BES3	$e^+e^- \rightarrow \phi \eta$
2177.5 ± 4.8 ± 19.5		⁵ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta' \phi$
2126.5 ± 16.8 ± 12.4		⁶ ABLIKIM	20S BES3	$e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2215.7 ± 8.3		⁷ LICHARD	23 RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$
2169 ± 5 ± 6		⁸ ZHU	23A RVUE	$e^+e^- \rightarrow \eta \phi$
2273.7 ± 5.7 ± 19.3		⁹ ABLIKIM	21AP BES3	$e^+e^- \rightarrow K_S^0 K_L^0$
2135 ± 8 ± 9	95	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta \phi f_0(980)$
2239.2 ± 7.1 ± 11.3		¹⁰ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+ K^-$
2200 ± 6 ± 5	471	ABLIKIM	15H BES3	$J/\psi \rightarrow \eta \phi \pi^+ \pi^-$
2180 ± 8 ± 8	11,12	LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
2079 ± 13 $\begin{smallmatrix} +79 \\ -28 \end{smallmatrix}$	4.8k	¹³ SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
2186 ± 10 ± 6	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
2125 ± 22 ± 10	483	AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \phi \eta \gamma$
2192 ± 14	116	¹⁴ AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
2169 ± 20	149	¹⁴ AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
2175 ± 10 ± 15	201	^{12,15} AUBERT, BE	06D BABR	$10.6 e^+e^- \rightarrow K^+ K^- \pi \pi \gamma$

OCCUR=2

NODE=M103M;LINKAGE=N
NODE=M103M;LINKAGE=J

NODE=M103M;LINKAGE=I

NODE=M103M;LINKAGE=G

NODE=M103M;LINKAGE=D

NODE=M103M;LINKAGE=E

NODE=M103M;LINKAGE=K

NODE=M103M;LINKAGE=L

NODE=M103M;LINKAGE=H

NODE=M103M;LINKAGE=C

NODE=M103M;LINKAGE=A

NODE=M103M;LINKAGE=AB

NODE=M103M;LINKAGE=SH

NODE=M103M;LINKAGE=AU

NODE=M103M;LINKAGE=B

¹ Seen in $e^+e^- \rightarrow K^*(892)^0 \bar{K}^0 \rightarrow K_S^0 K_L^0 \pi^0$ with a significance of 3.2 σ .² From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.³ By a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.⁴ From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.⁵ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.⁶ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.⁷ From a VDM fit to ZHU 23 $\eta \phi \gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7 σ statistical evidence.⁸ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta \phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2 σ .⁹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.¹⁰ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.¹¹ Fit includes interference with the $\phi(1680)$.¹² From the $\phi f_0(980)$ component.¹³ From a fit with two incoherent Breit-Wigners.¹⁴ From the $K^+ K^- f_0(980)$ component.¹⁵ Superseded by LEES 12F. $\phi(2170)$ WIDTH

NODE=M103W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M103W

88 $\frac{+26}{-21}$ **OUR AVERAGE** Error includes scale factor of 2.5. See the ideogram below.
 [106 $\frac{+24}{-18}$ MeV OUR 2024 AVERAGE Scale factor = 2.0]

NEW

32.4 \pm 21.0 \pm 1.8		¹ ABLIKIM	24AN BES3	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
140 \pm 36 \pm 16		² ABLIKIM	23AX BES3	$e^+e^- \rightarrow \phi \pi^+ \pi^-$
191 \pm 28 \pm 60		³ ABLIKIM	22L BES3	2.0-3.08 $e^+e^- \rightarrow K^+ K^- \pi^0$
31.1 $\frac{+21.1}{-11.6}$ \pm 1.1		⁴ ABLIKIM	21T BES3	$e^+e^- \rightarrow \phi \eta$
149.0 \pm 15.6 \pm 8.9		⁵ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta' \phi$
106.9 \pm 32.1 \pm 28.1		⁶ ABLIKIM	20S BES3	$e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
35 \pm 23		⁷ LICHARD	23 RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$
96 $\frac{+17}{-14}$ \pm 9		⁸ ZHU	23A RVUE	$e^+e^- \rightarrow \eta \phi$
86 \pm 44 \pm 51		⁹ ABLIKIM	21AP BES3	$e^+e^- \rightarrow K_S^0 K_L^0$
104 \pm 24 \pm 12	95	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta \phi f_0(980)$
139.8 \pm 12.3 \pm 20.6		¹⁰ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+ K^-$
104 \pm 15 \pm 15	471	ABLIKIM	15H BES3	$J/\psi \rightarrow \eta \phi \pi^+ \pi^-$
77 \pm 15 \pm 10		^{11,12} LEES	12F BABR	10.6 $e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
192 \pm 23 $\frac{+25}{-61}$	4.8k	¹³ SHEN	09 BELL	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
65 \pm 23 \pm 17	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta \phi f_0(980)$
61 \pm 50 \pm 13	483	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow \phi \eta \gamma$
71 \pm 21	116	¹⁴ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
102 \pm 27	149	¹⁴ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
58 \pm 16 \pm 20	201	^{12,15} AUBERT, BE	06D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi \pi \gamma$

OCCUR=2

¹ Seen in $e^+e^- \rightarrow K^*(892)^0 \bar{K}^0 \rightarrow K_S^0 K_L^0 \pi^0$ with a significance of 3.2 σ .

² From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.

³ By a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

⁴ From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.

⁵ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

⁶ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

⁷ From a VDM fit to ZHU 23 $\eta \phi \gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7 σ statistical evidence.

⁸ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta \phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2 σ .

⁹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

¹⁰ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹¹ Fit includes interference with the $\phi(1680)$.

¹² From the $\phi f_0(980)$ component.

¹³ From a fit with two incoherent Breit-Wigners.

¹⁴ From the $K^+ K^- f_0(980)$ component.

¹⁵ Superseded by LEES 12F.

NODE=M103W;LINKAGE=N
 NODE=M103W;LINKAGE=J

NODE=M103W;LINKAGE=I

NODE=M103W;LINKAGE=G

NODE=M103W;LINKAGE=D

NODE=M103W;LINKAGE=E

NODE=M103W;LINKAGE=K

NODE=M103W;LINKAGE=L

NODE=M103W;LINKAGE=H

NODE=M103W;LINKAGE=C

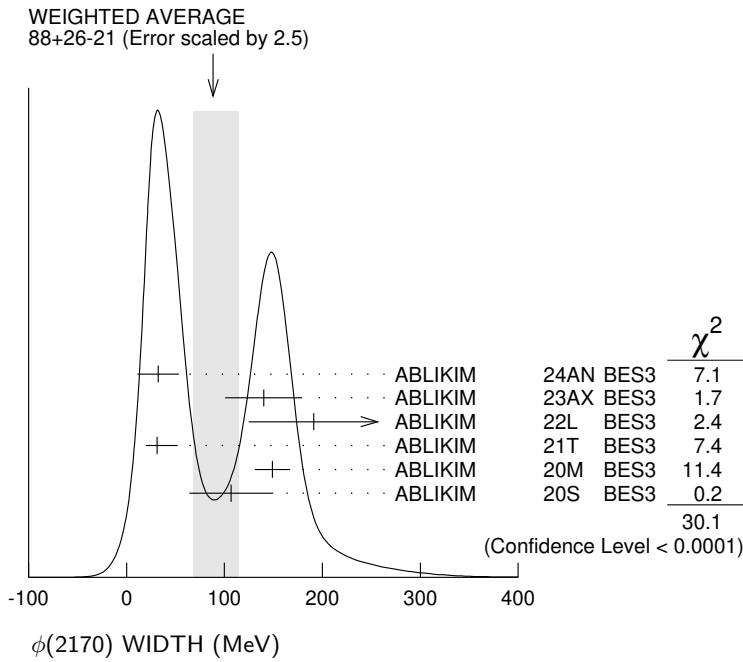
NODE=M103W;LINKAGE=A

NODE=M103W;LINKAGE=AB

NODE=M103W;LINKAGE=SH

NODE=M103W;LINKAGE=AU

NODE=M103W;LINKAGE=B



$\phi(2170)$ DECAY MODES

NODE=M103215;NODE=M103

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\phi\eta$	seen
Γ_3 $\phi\eta'$	seen
Γ_4 $\phi\pi\pi$	seen
Γ_5 $\phi f_0(980)$	seen
Γ_6 $K_S^0 K_L^0$	
Γ_7 $K^+ K^- \pi^+ \pi^-$	
Γ_8 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
Γ_9 $K^+ K^- \pi^0 \pi^0$	
Γ_{10} $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
Γ_{11} $K^{*0} K^\pm \pi^\mp$	not seen
Γ_{12} $K^*(892)^0 \bar{K}^*(892)^0$	not seen
Γ_{13} $K^*(892)^+ K^*(892)^-$	
Γ_{14} $K^*(892)^+ K^- + c.c.$	
Γ_{15} $K^*(892)^0 \bar{K}^0$	
Γ_{16} $K(1460)^+ K^- + c.c.$	
Γ_{17} $K_1(1270)^+ K^- + c.c.$	
Γ_{18} $K_1(1400)^+ K^- + c.c.$	
Γ_{19} $K_2^*(1430)^+ K^- + c.c.$	

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=11;OUR EVAL;→ UNCHECKED ←
 DESIG=9
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=17
 DESIG=3
 DESIG=6
 DESIG=4
 DESIG=7
 DESIG=8
 DESIG=10
 DESIG=15
 DESIG=19
 DESIG=21
 DESIG=12
 DESIG=14
 DESIG=13
 DESIG=18

$\phi(2170) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

NODE=M103230

$\Gamma(\phi\eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL% EVTS DOCUMENT ID TECN COMMENT
0.17	90 1 ZHU 23 BELL $e^+ e^- \rightarrow \mathcal{T}(nS) \rightarrow \phi\eta\gamma$
$0.36^{+0.05}_{-0.03} \pm 0.07$ to $41 \pm 2 \pm 6$	2 ZHU 23A RVUE $e^+ e^- \rightarrow \eta\phi$
$0.24^{+0.12}_{-0.07}$	3 ABLIKIM 21T BES3 $e^+ e^- \rightarrow \phi\eta$
$1.7 \pm 0.7 \pm 1.3$	483 AUBERT 08S BABR $10.6 e^+ e^- \rightarrow \phi\eta\gamma$

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M103G2
 NODE=M103G2

¹ From a solution of the fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution with mass and width of $\phi(2170)$ fixed at 2163.5 MeV and 31.1 MeV respectively. Four solutions are found with equal fit quality giving 0.17 eV (solution I and II) and 18.6 eV (III and IV) at 90% CL.

NODE=M103G2;LINKAGE=B

² From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2σ . Four solutions are found, with equal fit quality: $(0.56^{+0.03}_{-0.02} \pm 0.07)$ eV, $(0.36^{+0.05}_{-0.03} \pm 0.07)$ eV, $(38 \pm 1 \pm 5)$ eV, $(41 \pm 2 \pm 6)$ eV.

NODE=M103G2;LINKAGE=C

³ From a solution of the fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term. The other solution gives $10.11^{+3.87}_{-3.13}$ eV.

NODE=M103G2;LINKAGE=A

$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
7.1±0.7±0.7	¹ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta'\phi$

NODE=M103R00
NODE=M103R00

¹ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

NODE=M103R00;LINKAGE=A

$\Gamma(\phi f_0(980)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.3±0.3		^{1,2} LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
2.5±0.8±0.4	201	^{2,3} AUBERT,BE	06D BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi\pi\gamma$

NODE=M103G1
NODE=M103G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a fit with constructive interference with the $\phi(1680)$. In a fit with destructive interference, the value is larger by a factor of 12.

NODE=M103G1;LINKAGE=A

² For $f_0(980) \rightarrow \pi\pi$.

NODE=M103G1;LINKAGE=AB

³ Superseded by LEES 12F.

NODE=M103G1;LINKAGE=B

$\Gamma(K_S^0 K_L^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
0.9±0.6±0.7	¹ ABLIKIM	21AP BES3	$e^+e^- \rightarrow K_S^0 K_L^0$

NODE=M103R10
NODE=M103R10

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

NODE=M103R10;LINKAGE=A

$\Gamma(K^*(892)^+ K^*(892)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	¹ ABLIKIM	20s BES3	$e^+e^- \rightarrow K^+K^-\pi^0\pi^0$

NODE=M103R08
NODE=M103R08

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

NODE=M103R08;LINKAGE=A

$\Gamma(K^*(892)^+ K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.0±0.3	¹ ABLIKIM	22L BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$

NODE=M103R11
NODE=M103R11

¹ From a solution of a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 7.1 ± 0.9 eV. Significance 3.7σ .

NODE=M103R11;LINKAGE=A

$\Gamma(K^*(892)^0 \bar{K}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.0±0.2±0.1	¹ ABLIKIM	24AN BES3	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
73.6±4.4±2.0	² ABLIKIM	24AN BES3	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$

NODE=M103R15
NODE=M103R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Solution 1 of 2. Seen in $e^+e^- \rightarrow K^*(892)^0 \bar{K}^0 \rightarrow K_S^0 K_L^0 \pi^0$ with a significance of 3.2σ .

OCCUR=2

² Solution 2 of 2. Seen in $e^+e^- \rightarrow K^*(892)^0 \bar{K}^0 \rightarrow K_S^0 K_L^0 \pi^0$ with a significance of 3.2σ .

NODE=M103R15;LINKAGE=A

NODE=M103R15;LINKAGE=B

$$\Gamma(K(1460)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{16} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.0 ± 3.8	¹ ABLIKIM	20s	BES3 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$
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¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

NODE=M103R05
NODE=M103R05

NODE=M103R05;LINKAGE=A

$$\Gamma(K_1(1270)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{17} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<12.5	90	¹ ABLIKIM	20s	BES3 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$
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¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives an upper limit value of 297.6 eV.

NODE=M103R06
NODE=M103R06

NODE=M103R06;LINKAGE=A

$$\Gamma(K_1(1400)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{18} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.7 ± 3.3	¹ ABLIKIM	20s	BES3 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$
-----------	----------------------	-----	--

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives a value of 98.8 ± 7.8 eV.

NODE=M103R07
NODE=M103R07

NODE=M103R07;LINKAGE=A

$$\Gamma(K_2^*(1430)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

12.6 ± 2.4	¹ ABLIKIM	22L	BES3 2.0–3.08 $e^+ e^- \rightarrow K^+ K^- \pi^0$
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¹ From a solution of a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 161.1 ± 20.6 eV.

NODE=M103R12
NODE=M103R12

NODE=M103R12;LINKAGE=A

$\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M103220

$$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.65 ± 0.15 ± 0.18	4.8k	¹ SHEN	09	BELL 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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¹ Multiplied by 3/2 to take into account the $\phi \pi^0 \pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.

NODE=M103G01
NODE=M103G01

NODE=M103G01;LINKAGE=SH

$\phi(2170)$ BRANCHING RATIOS

NODE=M103225

$$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	23AX	BES3 $e^+ e^- \rightarrow \phi \pi^+ \pi^-$
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¹ From a fit to the $e^+ e^-$ cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.

NODE=M103R13
NODE=M103R13

NODE=M103R13;LINKAGE=A

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	AUBERT	07AK	BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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NODE=M103R01
NODE=M103R01

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{10} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	AUBERT	07AK	BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
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NODE=M103R02
NODE=M103R02

$$\Gamma(K^{*0} K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{11} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	AUBERT	07AK	BABR 10.6 GeV $e^+ e^-$
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NODE=M103R03
NODE=M103R03

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$ Γ_{12} / Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M103R04
 NODE=M103R04

 $\phi(2170)$ REFERENCES

ABLIKIM	24AN	JHEP 2401 180	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62698
ABLIKIM	23AX	PR D108 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62350
LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)	REFID=62426
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)	REFID=61911
ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)	REFID=62439
ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61649
ABLIKIM	21AP	PR D104 092014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61448
ABLIKIM	21T	PR D104 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61154
ABLIKIM	20M	PR D102 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60337
ABLIKIM	20S	PRL 124 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60542
ABLIKIM	19I	PR D99 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59605
ABLIKIM	19L	PR D99 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59612
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56773
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53349
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52154
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511

NODE=M103

REFID=62698
 REFID=62350
 REFID=62426
 REFID=61911
 REFID=62439
 REFID=61649
 REFID=61448
 REFID=61154
 REFID=60337
 REFID=60542
 REFID=59605
 REFID=59612
 REFID=56773
 REFID=54298
 REFID=53349
 REFID=53000
 REFID=52154
 REFID=52242
 REFID=51908
 REFID=51511

 $f_0(2200)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

Seen in $K_S^0 K_S^0$ (AUGUSTIN 88), $K^+ K^-$ (ABLIKIM 05Q) and $\eta\eta$ (BINON 05) system. Not seen in $\Upsilon(1S)$ radiative decays (BARU 89).

NODE=M112

NODE=M112

 $f_0(2200)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2187 ± 14 OUR AVERAGE				
$2170 \pm 20^{+10}_{-15}$		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
2197 ± 17		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2200 ± 25		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$2206 \pm 12 \pm 8$	381	^{2,3} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
$2188 \pm 17 \pm 16$	203	^{2,3} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
2210 ± 50		⁴ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta\eta n$
~ 2122		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2321		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M112M

NODE=M112M

OCCUR=2

OCCUR=2

¹ Cannot determine spin to be 0.² Using CLEO-c data but not authored by the CLEO Collaboration.³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 238$ MeV.⁴ First solution, PWA is ambiguous.

NODE=M112M;LINKAGE=A

NODE=M112M;LINKAGE=B

NODE=M112M;LINKAGE=C

NODE=M112M;LINKAGE=BI

 $f_0(2200)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
210 ± 40 OUR AVERAGE			
$220 \pm 60^{+40}_{-45}$	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
201 ± 51	⁵ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
150 ± 30	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
380 ± 90	⁶ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta\eta n$
~ 273	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 223	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M112W

NODE=M112W

OCCUR=2

⁵ Cannot determine spin to be 0.⁶ First solution, PWA is ambiguous.

NODE=M112W;LINKAGE=A

NODE=M112W;LINKAGE=BI

$f_0(2200)$ REFERENCES

SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	NODE=M112
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=61091
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=56805
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50958
		Translated from YAF 68 998.			REFID=50780
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)	REFID=40917
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574

 $f_J(2220)$

$$I^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$$

OMITTED FROM SUMMARY TABLE

See our mini-review in the 2004 edition of this *Review*, PDG 04. **$f_J(2220)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2231.1 ± 3.5 OUR AVERAGE					
2235 ± 4 ± 6	74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$	
2230 $^{+6}_{-7}$ ±16	46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$	OCCUR=2
2232 $^{+8}_{-7}$ ±15	23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$	OCCUR=3
2235 ± 4 ± 5	32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$	OCCUR=4
2209 $^{+17}_{-15}$ ±10		ASTON	88F LASS	11 $K^-p \rightarrow K^+K^- \Lambda$	
2230 ±20		BOLONKIN	88 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$	
2220 ±10	41	¹ ALDE	86B GA24	38-100 $\pi p \rightarrow n\eta\eta'$	
2230 ± 6 ±14	93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$	
2232 ± 7 ± 7	23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$	OCCUR=2
••• We do not use the following data for averages, fits, limits, etc. •••					
2223.9 ± 2.5		² VLADIMIRSK...08	SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$	
2246 ±36		BAI	98H BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$	
¹ ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors.					NODE=M082M;LINKAGE=A
² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated					NODE=M082M;LINKAGE=VL

 $f_J(2220)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
23 $^{+8}_{-7}$ OUR AVERAGE						
19 $^{+13}_{-11}$ ±12		74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$	
20 $^{+20}_{-15}$ ±17		46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$	OCCUR=2
20 $^{+25}_{-16}$ ±14		23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$	OCCUR=3
15 $^{+12}_{-9}$ ± 9		32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$	OCCUR=4
60 $^{+107}_{-57}$			ASTON	88F LASS	11 $K^-p \rightarrow K^+K^- \Lambda$	
80 ± 30			BOLONKIN	88 SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n$	
26 $^{+20}_{-16}$ ±17		93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+K^-$	
18 $^{+23}_{-15}$ ±10		23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$	OCCUR=2
••• We do not use the following data for averages, fits, limits, etc. •••						
8.6 ± 2.5			¹ VLADIMIRSK...08	SPEC	40 $\pi^-p \rightarrow K_S^0 K_S^0 n + m\pi^0$	
<80	90		ALDE	87C GAM2	38 $\pi^-p \rightarrow \eta'\eta n$	
¹ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated						NODE=M082W;LINKAGE=VL

$f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	not seen
Γ_2 $\pi^+\pi^-$	not seen
Γ_3 $K\bar{K}$	not seen
Γ_4 $\rho\bar{\rho}$	not seen
Γ_5 $\gamma\gamma$	not seen
Γ_6 $\eta\eta'(958)$	seen
Γ_7 $\phi\phi$	not seen
Γ_8 $\eta\eta$	not seen

DESIG=5

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

 $f_J(2220) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M082220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_3\Gamma_5/\Gamma$	
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
< 1.4	95	¹ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
< 5.6	95	¹ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
< 86	95	¹ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$	
<1000	95	² ALTHOFF	85B TASS	$\gamma\gamma, K\bar{K}\pi$	

NODE=M082G1

NODE=M082G1

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_5/\Gamma$	
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<2.5	95	ALAM	98C CLE2	$\gamma\gamma \rightarrow \pi^+\pi^-$	
¹ Assuming $J^P = 2^+$.					
² True for $J^P = 0^+$ and $J^P = 2^+$.					

NODE=M082G3

NODE=M082G3

NODE=M082G1;LINKAGE=D

NODE=M082G1;LINKAGE=C

 $f_J(2220) \Gamma(i)\Gamma(\rho\bar{\rho})/\Gamma^2(\text{total})$

NODE=M082223

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\pi\pi)/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma \times \Gamma_1/\Gamma$	
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<18	95	¹ AMSLER	01 CBAR	$1.4-1.5 \rho\bar{\rho} \rightarrow \pi^0\pi^0$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<(11-42)	99	² HASAN	96 SPEC	$1.35-1.55 \rho\bar{\rho} \rightarrow \pi^+\pi^-$	

NODE=M082GG1

NODE=M082GG1

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma \times \Gamma_7/\Gamma$	
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<6	95	³ EVANGELIS...	98 SPEC	$1.1-2.0 \rho\bar{\rho} \rightarrow \phi\phi$	

NODE=M082GG2

NODE=M082GG2

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma \times \Gamma_8/\Gamma$	
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<4	95	¹ AMSLER	01 CBAR	$1.4-1.5 \rho\bar{\rho} \rightarrow \eta\eta$	
¹ For $J^P = 2^+$ in the mass range 2222–2240 MeV and the total width between 10 and 20 MeV.					
² For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220–2245 MeV and the total width of 15 MeV.					
³ For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.					

NODE=M082GG;LINKAGE=A

NODE=M082GG;LINKAGE=B

NODE=M082GG;LINKAGE=C

 $f_J(2220)$ BRANCHING RATIOS

NODE=M082225

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE		DOCUMENT ID	TECN	COMMENT	
not seen		¹ DOBBS	15	$J/\psi \rightarrow \gamma\pi\pi$	
not seen		¹ DOBBS	15	$\psi(2S) \rightarrow \gamma\pi\pi$	
¹ Using CLEO-c data but not authored by the CLEO Collaboration.					

NODE=M082R00

NODE=M082R00

OCCUR=2

NODE=M082R00;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$				Γ_3/Γ	
VALUE		DOCUMENT ID	TECN	COMMENT	
not seen		¹ DOBBS	15	$J/\psi \rightarrow \gamma K\bar{K}$	
not seen		¹ DOBBS	15	$\psi(2S) \rightarrow \gamma K\bar{K}$	
¹ Using CLEO-c data but not authored by the CLEO Collaboration.					

NODE=M082R01

NODE=M082R01

OCCUR=2

NODE=M082R01;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_3
1.0±0.5	BAI	96B	BES $e^+e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\bar{K}$	

NODE=M082R2
 NODE=M082R2

 $\Gamma(p\bar{p})/\Gamma_{total}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
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NODE=M082R1
 NODE=M082R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen		¹ AUBERT	07AV	BABR	$B \rightarrow p\bar{p}K^{(*)}$
not seen		WANG	05A	BELL	$B^+ \rightarrow \bar{p}pK^+$
<3.0	95	² EVANGELIS...	97	SPEC	$1.96-2.40 \bar{p}p \rightarrow K_S^0 K_S^0$
<1.1	99.7	³ BARNES	93	SPEC	$1.3-1.57 \bar{p}p \rightarrow K_S^0 K_S^0$
<2.6	99.7	³ BARDIN	87	CNTR	$1.3-1.5 \bar{p}p \rightarrow K^+ K^-$
<3.6	99.7	³ SCULLI	87	CNTR	$1.29-1.55 \bar{p}p \rightarrow K^+ K^-$

¹ Assuming $\Gamma < 30$ MeV.

² Assuming $\Gamma \sim 20$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.

³ Assuming $\Gamma = 30-35$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.

NODE=M082R1;LINKAGE=AU
 NODE=M082R1;LINKAGE=C
 NODE=M082R1;LINKAGE=B

 $\Gamma(p\bar{p})/\Gamma(K\bar{K})$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_3
0.17±0.09	BAI	96B	BES $e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}, K\bar{K}$	

NODE=M082R3
 NODE=M082R3

 $f_J(2220)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirov <i>et al.</i>	(ITEP)	REFID=52681
		Translated from YAF 71 2166.			
AUBERT	07AV	PR D76 092004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51990
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)	REFID=50651
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
AMSLER	01	PL B520 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48558
ALAM	98C	PRL 81 3328	M.S. Alam <i>et al.</i>	(CLEO Collab.)	REFID=46326
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
EVANGELIS...	98	PR D57 5370	C. Evangelista <i>et al.</i>	(JETSET Collab.)	REFID=46365
EVANGELIS...	97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)	REFID=45687
GODANG	97	PRL 79 3829	R. Godang <i>et al.</i>	(CLEO Collab.)	REFID=45760
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44736
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REFID=45197
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REFID=43601
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ASTON	88F	PL B215 199	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP	REFID=40585
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
ALDE	87C	SJNP 45 255	D. Alde <i>et al.</i>		REFID=47474
		Translated from YAF 45 405.			
BARDIN	87	PL B195 292	G. Bardin <i>et al.</i>	(SACL, FERR, CERN, PADO+)	REFID=40235
SCULLI	87	PRL 58 1715	J. Sculli <i>et al.</i>	(NYU, BNL)	REFID=40023
ALDE	86B	PL B177 120	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=21864
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)	REFID=21865
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349

OTHER RELATED PAPERS

DEL-AMO-SA...	100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53533
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$\omega(2220)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M270

OMITTED FROM SUMMARY TABLE

 $\omega(2220)$ MASS

NODE=M270M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2188±21 OUR AVERAGE [2024 AVERAGE]	Error includes scale factor of 1.2. [2232 ± 33 MeV OUR AVERAGE]		
2153±30±31	¹ ABLIKIM	24AJ BES3	$e^+e^- \rightarrow \omega\eta'$
2232±19±27	² ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi\pi$
2176±24±3	³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2250±25±27	⁴ ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi^+\pi^-$
2222±7±2	⁵ ABLIKIM	22I BES3	2.0–3.8 $e^+e^- \rightarrow \omega\pi^0\pi^0$
2205±30	⁶ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
¹ From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.			
² From a fit to $\omega\pi^+\pi^-$ and $\omega\pi^0\pi^0$ with a Breit-Wigner resonance interfering with the continuum. Supersedes ABLIKIM 22I.			
³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.			
⁴ From a fit to $\omega\pi^+\pi^-$ with a Breit-Wigner resonance interfering with the continuum.			
⁵ From the fit to the cross section by the coherent sum of resonant component parametrized by a modified Breit-Wigner amplitude and a phase-space contribution for the continuum.			
⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.			

NODE=M270M
NEW

OCCUR=2

NODE=M270M;LINKAGE=F

NODE=M270M;LINKAGE=A

NODE=M270M;LINKAGE=E

NODE=M270M;LINKAGE=B

NODE=M270M;LINKAGE=C

NODE=M270M;LINKAGE=D

 $\omega(2220)$ WIDTH

NODE=M270W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
105±34 OUR AVERAGE [90 ± 60 MeV OUR 2024 AVERAGE]			
167±77±7	¹ ABLIKIM	24AJ BES3	$e^+e^- \rightarrow \omega\eta'$
93±53±20	² ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi\pi$
89±50±5	³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega\eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
125±43±15	⁴ ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi^+\pi^-$
59±30±6	⁵ ABLIKIM	22I BES3	2.0–3.8 $e^+e^- \rightarrow \omega\pi^0\pi^0$
350±90	⁶ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
¹ From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.			
² From a fit to $\omega\pi^+\pi^-$ and $\omega\pi^0\pi^0$ with a Breit-Wigner resonance interfering with the continuum. Supersedes ABLIKIM 22I.			
³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.			
⁴ From a fit to $\omega\pi^+\pi^-$ with a Breit-Wigner resonance interfering with the continuum.			
⁵ From the fit to the cross section by the coherent sum of resonant component parametrized by a modified Breit-Wigner amplitude and a phase-space contribution for the continuum.			
⁶ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.			

NODE=M270W
NEW

OCCUR=2

NODE=M270W;LINKAGE=F

NODE=M270W;LINKAGE=A

NODE=M270W;LINKAGE=E

NODE=M270W;LINKAGE=B

NODE=M270W;LINKAGE=C

NODE=M270W;LINKAGE=D

 $\omega(2220)$ DECAY MODES

NODE=M270215;NODE=M270

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega\pi\pi$	seen
Γ_2 $\omega\pi^+\pi^-$	seen
Γ_3 $\omega\pi^0\pi^0$	seen
Γ_4 $\omega\eta$	seen
Γ_5 $\omega\eta'$	seen
Γ_6 e^+e^-	seen

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

$\omega(2220) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M270235

$$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_3\Gamma_6/\Gamma$$

NODE=M270G00
NODE=M270G00

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.3±0.1±0.1	¹ ABLIKIM	22I	BES3 2.0–3.8 e ⁺ e ⁻ → ωπ ⁰ π ⁰
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¹ Superseded by ABLIKIM 23G.

NODE=M270G00;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2\Gamma_6/\Gamma$$

NODE=M270R01
NODE=M270R01

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.9±0.4±0.4	¹ ABLIKIM	23G	BES3 2.0–3.1 e ⁺ e ⁻ → ωπ ⁺ π ⁻
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¹ From a fit to ωπ⁺π⁻ with a Breit-Wigner resonance interfering with the continuum. Solution with constructive interference: 52.9 ± 17.0 ± 13.1 eV.

NODE=M270R01;LINKAGE=A

$$\Gamma(\omega\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1\Gamma_6/\Gamma$$

NODE=M270R00
NODE=M270R00

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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0.9±0.5±0.2	¹ ABLIKIM	23G	BES3 2.0–3.1 e ⁺ e ⁻ → ωππ
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¹ From a fit to ωπ⁺π⁻ and ωπ⁰π⁰ with a Breit-Wigner resonance interfering with the continuum. Solution with constructive interference: 61.1 ± 32.1 ± 15.4 eV. Supersedes ABLIKIM 22I.

NODE=M270R00;LINKAGE=A

$$\Gamma(\omega\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4\Gamma_6/\Gamma$$

NODE=M270R02
NODE=M270R02

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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0.43±0.15±0.04	¹ ABLIKIM	21A	BES3 e ⁺ e ⁻ → ωη
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¹ For constructive interference with ω(1420) and ω(1650)/φ(1680). For destructive interference: 1.25 ± 0.48 ± 0.18 eV.

NODE=M270R02;LINKAGE=A

$$\Gamma(\omega\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_5\Gamma_6/\Gamma$$

NODE=M270R03
NODE=M270R03

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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4.2 ± 1.5 OUR AVERAGE

5.72±1.68±1.5	¹ ABLIKIM	24AJ	BES3 e ⁺ e ⁻ → ωη'
2.99±1.68±1.2	² ABLIKIM	24AJ	BES3 e ⁺ e ⁻ → ωη'

¹ Solution 1 of the two solutions.² Solution 2 of the two solutions.

OCCUR=2

NODE=M270R03;LINKAGE=A
NODE=M270R03;LINKAGE=B $\omega(2220)$ REFERENCES

NODE=M270

ABLIKIM	24AJ	JHEP 2407 093	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62691
ABLIKIM	23G	JHEP 2301 111	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62049
	Also	JHEP 2303 093 (errata.)	M. Ablikim, <i>et. al.</i>	(BESIII Collab.)	REFID=62054
ABLIKIM	22I	PR D105 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61644
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61028
ANISOVICH	02B	PL B542 19	A.V. Anisovich <i>et al.</i>		REFID=48829
ANISOVICH	01C	PL B507 23	A.V. Anisovich <i>et al.</i>		REFID=48325
ANISOVICH	00D	PL B476 15	A.V. Anisovich <i>et al.</i>		REFID=47944

$\eta(2225)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Seen in $J/\psi \rightarrow \gamma\phi\phi$. Possibly seen in $B \rightarrow \phi\phi K$ by LEES 11A.

NODE=M115

NODE=M115

NODE=M115M

NODE=M115M

 $\eta(2225)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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2221⁺¹³₋₁₀ OUR AVERAGE

2216 ⁺⁴ ₋₅ ⁺²¹ ₋₁₁		¹ ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2240 ⁺³⁰ ₋₂₀ ⁺³⁰ ₋₂₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2230 ± 25 ± 15		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2214 ± 20 ± 13		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

OCCUR=2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 2220

BISELLO 86B DM2 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$ that also finds significant signals for for $\eta(2100)$, 0^-+ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^-+ state $X(2500)$ ($M = 2470^{+15}_{-19} +^{101}_{-23}$ MeV, $\Gamma = 230^{+64}_{-35} +^{56}_{-33}$ MeV).

NODE=M115M;LINKAGE=B

 $\eta(2225)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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185⁺⁴⁰₋₂₀ OUR AVERAGE

185 ⁺¹² ₋₁₄ ⁺⁴³ ₋₁₇		¹ ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
190 ± 30 ⁺⁶⁰ ₋₄₀	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
150 ⁺³⁰⁰ ₋₆₀ ± 60		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 80

BISELLO 86B DM2 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$ that also finds significant signals for for $\eta(2100)$, 0^-+ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^-+ state $X(2500)$ ($M = 2470^{+15}_{-19} +^{101}_{-23}$ MeV, $\Gamma = 230^{+64}_{-35} +^{56}_{-33}$ MeV).

NODE=M115W;LINKAGE=A

 $\eta(2225)$ REFERENCES

ABLIKIM	16N	PR D93 112011	M. Ablikim	(BESIII Collab.)
LEES	11A	PR D84 012001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)

NODE=M115

REFID=57512
REFID=16595
REFID=52255
REFID=41354
REFID=22101

$\rho_3(2250)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

NODE=M044

OMITTED FROM SUMMARY TABLE

Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $f_4(2300)$, $\rho_5(2350)$.

NODE=M044

 $\rho_3(2250)$ MASS

NODE=M044205

 $\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$2248 \pm 17^{+59}_{-5}$	1.8k	1 ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
~ 2232		HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2090		2 OAKDEN	94	RVUE	0.36-1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2250		3 MARTIN	80B	RVUE	
~ 2300		3 MARTIN	80C	RVUE	
~ 2140		4 CARTER	78B	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2150		5 CARTER	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

NODE=M044M1
NODE=M044M1

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

NODE=M044M1;LINKAGE=A

² See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

NODE=M044M1;LINKAGE=CC

³ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

NODE=M044M1;LINKAGE=P

⁴ $I = 0, 1. J^P = 3^-$ from Barrelet-zero analysis.

NODE=M044M1;LINKAGE=K

⁵ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044M1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2260 ± 20	⁶ ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega \pi^0$, $\omega \eta \pi^0, \pi^+ \pi^-$
~ 2190	⁷ CUTTS	78B	CNTR	0.97-3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{7,8} COUPLAND	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{7,9} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2190 ± 10	¹⁰ ABRAMS	70	CNTR	S channel $\bar{p}N$

NODE=M044M2
NODE=M044M2

⁶ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M044M;LINKAGE=AY

⁷ Isospins 0 and 1 not separated.

NODE=M044M2;LINKAGE=I

⁸ From a fit to the total elastic cross section.

NODE=M044M2;LINKAGE=E

⁹ Referred to as T or T region by ALSPECTOR 73.

NODE=M044M2;LINKAGE=M

¹⁰ Seen as bump in $l = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M044M2;LINKAGE=B

Other processes

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$2290 \pm 20 \pm 30$	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M044M3
NODE=M044M3 **$\rho_3(2250)$ WIDTH**

NODE=M044210

 $\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$185^{+31+17}_{-26-103}$	1.8k	11 ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
~ 220		HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 60		12 OAKDEN	94	RVUE	0.36-1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250		13 MARTIN	80B	RVUE	
~ 200		13 MARTIN	80C	RVUE	
~ 150		14 CARTER	78B	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow K^- K^+$
~ 200		15 CARTER	77	CNTR 0	0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

NODE=M044W1
NODE=M044W1

¹¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+K^-\eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

NODE=M044W1;LINKAGE=A

¹² See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

NODE=M044W1;LINKAGE=CC

¹³ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

NODE=M044W1;LINKAGE=P

¹⁴ $I = 0, 1, J^P = 3^-$ from Barrelet-zero analysis.

NODE=M044W1;LINKAGE=K

¹⁵ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044W1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M044W2

NODE=M044W2

• • • We do not use the following data for averages, fits, limits, etc. • • •

160±25	¹⁶ ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega\pi^0$, $\omega\eta\pi^0, \pi^+\pi^-$
135±75	^{17,18} COUPLAND	77	CNTR	0 0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
98±8	¹⁸ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	¹⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

NODE=M044W;LINKAGE=AY

¹⁶ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁷ From a fit to the total elastic cross section.

NODE=M044W2;LINKAGE=E

¹⁸ Isospins 0 and 1 not separated.

NODE=M044W2;LINKAGE=I

¹⁹ Seen as bump in $l = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M044W2;LINKAGE=B

Other processes

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M044W3

NODE=M044W3

• • • We do not use the following data for averages, fits, limits, etc. • • •

230±50±80	AMELIN	00	VES	37 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
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$\rho_3(2250)$ REFERENCES

NODE=M044

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>		REFID=48828
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>		REFID=48327
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>		REFID=48349
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP	REFID=21838
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP	REFID=21837
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)	REFID=21964
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)	REFID=21733
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP	REFID=21963
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)	REFID=21830
PEASLEE	75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)	REFID=21824
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)	REFID=21813
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)	REFID=21807
COOPER	68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)	REFID=21805

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M107

 $f_2(2300)$ MASS

NODE=M107M

NODE=M107M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2297±28	¹ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
••• We do not use the following data for averages, fits, limits, etc. •••			
2262± 4±28	² ABLIKIM 21A1	BES3	3.51-4.60 $e^+ e^- \rightarrow \phi \Lambda \bar{\Lambda}$
2243 ⁺⁷⁺³ ₋₆₋₂₉	³ UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2270±12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2327± 9± 6	ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
2340±13	⁴ LONGACRE 04	RVUE	22 $\pi^- p \rightarrow \phi \phi n$, 450 $pp \rightarrow p_f 4\pi p_s$
2231±10	BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2\phi Be$
2220 ⁺⁹⁰ ₋₂₀	LINDENBAUM 84	RVUE	
2320±40	ETKIN 82	MPS	22 $\pi^- p \rightarrow 2\phi n$

¹Includes data of ETKIN 85. The percentage of the resonance going into $\phi\phi 2^{++} S_2$, D_2 , and D_0 is 6^{+15}_-5 , 25^{+18}_-14 , and 69^{+16}_-27 , respectively.

²Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

³Spin 2 preferred, tentatively assigned to $f_2(2300)$.

⁴From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00C data.

NODE=M107M;LINKAGE=C

NODE=M107M;LINKAGE=B

NODE=M107M;LINKAGE=A

NODE=M107M;LINKAGE=D

 $f_2(2300)$ WIDTH

NODE=M107W

NODE=M107W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
149±41	¹ ETKIN 88	MPS	22 $\pi^- p \rightarrow \phi \phi n$
••• We do not use the following data for averages, fits, limits, etc. •••			
72± 5±43	² ABLIKIM 21A1	BES3	3.51-4.60 $e^+ e^- \rightarrow \phi \Lambda \bar{\Lambda}$
145±12 ⁺²⁷ ₋₃₄	³ UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
90±29	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
275±36±20	ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
148 ⁺⁶⁶ ₋₃₂	⁴ LONGACRE 04	RVUE	22 $\pi^- p \rightarrow \phi \phi n$, 450 $pp \rightarrow p_f 4\pi p_s$
133±50	BOOTH 86	OMEG	85 $\pi^- Be \rightarrow 2\phi Be$
200±50	LINDENBAUM 84	RVUE	
220±70	ETKIN 82	MPS	22 $\pi^- p \rightarrow 2\phi n$

¹Includes data of ETKIN 85.

²Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

³Spin 2 preferred, tentatively assigned to $f_2(2300)$.

⁴From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00C data.

NODE=M107W;LINKAGE=C

NODE=M107W;LINKAGE=B

NODE=M107W;LINKAGE=A

NODE=M107W;LINKAGE=D

 $f_2(2300)$ DECAY MODES

NODE=M107215;NODE=M107

Mode	Fraction (Γ_i/Γ)
Γ_1 $\phi\phi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\gamma\gamma$	seen
Γ_4 $\Lambda\bar{\Lambda}$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

 $f_2(2300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M107225

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_3/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
••• We do not use the following data for averages, fits, limits, etc. •••			
3.2 ^{+0.5+1.3} _{-0.4-2.2}	UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
44 ±6 ±12	¹ ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

¹Assuming spin 2.

NODE=M107G1

NODE=M107G1

NODE=M107G1;LINKAGE=AB

$f_2(2300)$ BRANCHING RATIOS

NODE=M107220

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BOOTH	86	OMEG 85 $\pi^- p \rightarrow 2\phi Be$
seen	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

NODE=M107R01
NODE=M107R01 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
seen	ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

NODE=M107R02
NODE=M107R02 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M107R03
NODE=M107R03 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	21A1	BES3 3.51-4.60 $e^+ e^- \rightarrow \phi\Lambda\bar{\Lambda}$

NODE=M107R00
NODE=M107R00

¹ Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

NODE=M107R00;LINKAGE=A

 $f_2(2300)$ REFERENCES

NODE=M107

ABLIKIM	21A1	PR D104 052006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61440
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
LONGACRE	04	PR D70 094041	R.S. Longacre, S.J. Lindenbaum	(BNL, CUNY)	REFID=50341
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=40285
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)	REFID=21870
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=21871
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)	REFID=21869
ETKIN	82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=21866

NODE=M041

 $f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

 $f_4(2300)$ MASS

NODE=M041205

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
•••	We do not use the following data for averages, fits, limits, etc. •••		
~ 2314	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE
~ 2300	¹ MARTIN	80C	RVUE
~ 2340	² CARTER	78B	CNTR 0.7-2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2330	DULUDE	78B	OSPK 1-2 $\bar{p}p \rightarrow \pi^0 \pi^0$
~ 2310	³ CARTER	77	CNTR 0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

¹ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

³ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041M1;LINKAGE=P
NODE=M041M1;LINKAGE=K
NODE=M041M1;LINKAGE=JS-CANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
•••	We do not use the following data for averages, fits, limits, etc. •••		
2283±17	⁴ ANISOVICH	00J	SPEC
~ 2380	⁵ CUTTS	78B	CNTR 0.97-3 $\bar{p}p \rightarrow \bar{N}N$
2345±15	^{5,6} COUPLAND	77	CNTR 0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
2359±2	^{5,7} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2375±10	ABRAMS	70	CNTR S channel $\bar{N}N$

NODE=M041M2
NODE=M041M2

⁴ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta\pi^0\pi^0$, $\pi^0\pi^0$, $\eta\eta$, $\eta\eta'$, $\pi^+\pi^-$.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

NODE=M041M2;LINKAGE=AN

NODE=M041M2;LINKAGE=I
NODE=M041M2;LINKAGE=E
NODE=M041M2;LINKAGE=M

$\pi^- p \rightarrow \eta\pi\pi n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

2330±20±40	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
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NODE=M041M3
NODE=M041M3

$\rho\rho$ CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
-------------	-------------	---------

2320±60 OUR ESTIMATE

••• We do not use the following data for averages, fits, limits, etc. •••

2332±15	BARBERIS	00F	450 $\rho\rho \rightarrow p_f\omega\omega p_s$
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NODE=M041M4
NODE=M041M4
→ UNCHECKED ←

$f_4(2300)$ WIDTH

NODE=M041210

$\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

••• We do not use the following data for averages, fits, limits, etc. •••

~ 278	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR 0.7-2.4 $\bar{p}p \rightarrow K^-K^+$
~ 210	¹⁰ CARTER	77	CNTR 0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041W1
NODE=M041W1

NODE=M041W1;LINKAGE=P
NODE=M041W1;LINKAGE=K
NODE=M041W1;LINKAGE=J

S-CHANNEL $\bar{p}p$ or $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

310± 25	¹¹ ANISOVICH	00J	SPEC
135 ⁺¹⁵⁰ ₋₆₅	^{12,13} COUPLAND	77	CNTR 0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
165 ⁺¹⁸ ₋₈	¹³ ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 190	ABRAMS	70	CNTR S channel $\bar{N}N$

¹¹ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta\pi^0\pi^0$, $\pi^0\pi^0$, $\eta\eta$, $\eta\eta'$, $\pi^+\pi^-$.

¹² From a fit to the total elastic cross section.

¹³ Isospins 0 and 1 not separated.

NODE=M041W2
NODE=M041W2

NODE=M041W2;LINKAGE=AN

NODE=M041W2;LINKAGE=E
NODE=M041W2;LINKAGE=I

$\pi^- p \rightarrow \eta\pi\pi n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

235±50±40	AMELIN	00	VES 37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
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NODE=M041W3
NODE=M041W3

$\rho\rho$ CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
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250±80 OUR ESTIMATE

••• We do not use the following data for averages, fits, limits, etc. •••

260±57	BARBERIS	00F	450 $\rho\rho \rightarrow p_f\omega\omega p_s$
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NODE=M041W4
NODE=M041W4
→ UNCHECKED ←

$f_4(2300)$ DECAY MODES

NODE=M041215;NODE=M041

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\rho$	seen
Γ_2 $\omega\omega$	seen
Γ_3 $\eta\pi\pi$	seen
Γ_4 $\pi\pi$	seen
Γ_5 $K\bar{K}$	seen
Γ_6 $N\bar{N}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

$f_4(2300)$ BRANCHING RATIOS $\Gamma(\rho\rho)/\Gamma(\omega\omega)$ Γ_1/Γ_2

VALUE	DOCUMENT ID	COMMENT
2.8 ± 0.5	BARBERIS 00F	450 $p\bar{p} \rightarrow p_f \omega \omega p_S$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M041220

NODE=M041R1
NODE=M041R1 $f_4(2300)$ REFERENCES

AMELIN 00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARBERIS 00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH 99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH 99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER 78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE 78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
CARTER 77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS 70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M041

REFID=47432
REFID=47950
REFID=47962
REFID=46903
REFID=46926
REFID=44103
REFID=21838
REFID=21837
REFID=21964
REFID=21733
REFID=21850
REFID=21963
REFID=21830
REFID=21813
REFID=21807

NODE=M169

 $f_0(2330)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

 $f_0(2330)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2312 \pm 7_{-3}^{+7}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
$2312 \pm 2_{-0}^{+10}$	² ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
2419 ± 64	³ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
2340 ± 20	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
2314 ± 25	⁴ BUGG	04A RVUE	
2337 ± 14	ANISOVICH	00J SPEC	$2.0 \bar{p}p \rightarrow \pi\pi, \eta\eta$
~ 2321	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M169M

NODE=M169M

- ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ *P*-wave.
² From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
³ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
⁴ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M169M;LINKAGE=C

NODE=M169M;LINKAGE=B

NODE=M169M;LINKAGE=A

NODE=M169M;LINKAGE=BU

 $f_0(2330)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$65 \pm 10_{-12}^{+3}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
$134 \pm 5_{-9}^{+30}$	² ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
274 ± 94	³ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
165 ± 25	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
144 ± 20	⁴ BUGG	04A RVUE	
217 ± 33	ANISOVICH	00J SPEC	$2.0 \bar{p}p \rightarrow \pi\pi, \eta\eta$
~ 223	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M169W

NODE=M169W

- ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ *P*-wave.
² From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
³ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
⁴ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M169W;LINKAGE=C

NODE=M169W;LINKAGE=B

NODE=M169W;LINKAGE=A

NODE=M169W;LINKAGE=BU

$f_0(2330)$ REFERENCES

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BUGG	04A	EPJ C36 161	D.V. Bugg	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M169

REFID=61891
 REFID=62033
 REFID=61637
 REFID=61610
 REFID=61091
 REFID=59455
 REFID=56984
 REFID=50158
 REFID=47950
 REFID=47965
 REFID=44103

 $f_2(2340)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M108

 $f_2(2340)$ MASS

NODE=M108M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2346⁺²¹₋₁₀ OUR AVERAGE				
2346 ± 8 ⁺²² ₋₆		¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
2362 ⁺³¹ ₋₃₀ - ¹⁴⁰ ₋₆₃	5.5k	² ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2339 ± 55		³ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2350 ± 7	80k	⁴ UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
2412 ⁺²⁸ ₋₃₂		⁵ LONGACRE	04 RVUE	$22 \pi^- p \rightarrow \phi \phi n, 450$ $pp \rightarrow p_f 4\pi p_s$
2392 ± 10		BOOTH	86 OMEG	$85 \pi^- Be \rightarrow 2\phi Be$
2360 ± 20		LINDENBAUM	84 RVUE	

NODE=M108M

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M108M;LINKAGE=B

² From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M108M;LINKAGE=A

³ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 37 ± 19 , 4^{+12}_{-4} , and 59^{+21}_{-19} , respectively.

NODE=M108M;LINKAGE=C

⁴ Statistical error only.

NODE=M108M;LINKAGE=ST

⁵ From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00c data.

NODE=M108M;LINKAGE=D

 $f_2(2340)$ WIDTH

NODE=M108W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
331⁺²⁷₋₁₈ OUR AVERAGE				
332 ± 14 ⁺²⁶ ₋₁₂		¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
334 ⁺⁶² ₋₅₄ - ¹⁶⁵ ₋₁₀₀	5.5k	² ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
319 ⁺⁸¹ ₋₆₉		³ ETKIN	88 MPS	$22 \pi^- p \rightarrow \phi \phi n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
218 ± 16	80k	⁴ UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
362 ⁺¹⁰⁰ ₋₅₃		⁵ LONGACRE	04 RVUE	$22 \pi^- p \rightarrow \phi \phi n, 450$ $pp \rightarrow p_f 4\pi p_s$
198 ± 50		BOOTH	86 OMEG	$85 \pi^- Be \rightarrow 2\phi Be$
150 ⁺¹⁵⁰ ₋₅₀		LINDENBAUM	84 RVUE	

NODE=M108W

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M108W;LINKAGE=B

² From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M108W;LINKAGE=A

³ Includes data of ETKIN 85.

NODE=M108W;LINKAGE=C

⁴ Statistical error only.

NODE=M108W;LINKAGE=ST

⁵ From a four pole K-matrix reanalysis of ETKIN 88 and BARBERIS 00c data.

NODE=M108W;LINKAGE=D

$f_2(2340)$ DECAY MODES

NODE=M108215;NODE=M108

Mode	Fraction (Γ_i/Γ)
Γ_1 $\phi\phi$	seen
Γ_2 $\eta\eta$	seen
Γ_3 $\eta'\eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2
DESIG=3

 $f_2(2340)$ BRANCHING RATIOS

NODE=M108220

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M108R01
NODE=M108R01

$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$	Γ_3/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$

NODE=M108R00
NODE=M108R00

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M108R00;LINKAGE=A

 $f_2(2340)$ REFERENCES

NODE=M108

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61637
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
LONGACRE	04	PR D70 094041	R.S. Longacre, S.J. Lindenbaum	(BNL, CUNY)	REFID=50341
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=40285
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)	REFID=21870
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)	REFID=21871
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)	REFID=21869

NODE=M033

 $\rho_5(2350)$

$$I^G(J^{PC}) = 1^+(5^{--})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_1(2400)$. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

NODE=M033

 $\rho_5(2350)$ MASS

NODE=M033205

 $\pi^- p \rightarrow \omega\pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2330±35	ALDE	95	GAM2 $38 \pi^- p \rightarrow \omega\pi^0 n$

NODE=M033M3
NODE=M033M3

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

NODE=M033M1
NODE=M033M1

••• We do not use the following data for averages, fits, limits, etc. •••

~ 2303	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE	
~ 2250	¹ MARTIN	80C	RVUE	
~ 2500	² CARTER	78B	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 2480	³ CARTER	77	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow \pi\pi$

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

NODE=M033M2
NODE=M033M2

••• We do not use the following data for averages, fits, limits, etc. •••

2300±45	⁴ ANISOVICH	02	SPEC	$0.6-1.9 \bar{p}p \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2295±30	ANISOVICH	00J	SPEC	
~ 2380	⁵ CUTTS	78B	CNTR	$0.97-3 \bar{p}p \rightarrow \bar{N}N$
2345±15	^{5,6} COUPLAND	77	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow \bar{p}p$
2359± 2	^{5,7} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2350±10	⁸ ABRAMS	70	CNTR	S channel $\bar{N}N$
2360±25	⁹ OH	70B	HDBC -0	$\bar{p}(pn), K^* K 2\pi$

$\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

••• We do not use the following data for averages, fits, limits, etc. •••

2307±6	ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$
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¹ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis.

³ $I(J^P) = 1(5^-)$ from amplitude analysis.

⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

⁸ For $I = 1 \bar{N}N$.

⁹ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.

NODE=M033M4
NODE=M033M4

NODE=M033M1;LINKAGE=P
NODE=M033M1;LINKAGE=K
NODE=M033M1;LINKAGE=J
NODE=M033M2;LINKAGE=AY

NODE=M033M2;LINKAGE=I
NODE=M033M2;LINKAGE=E
NODE=M033M2;LINKAGE=M
NODE=M033M2;LINKAGE=A
NODE=M033M2;LINKAGE=N

 $\rho_5(2350)$ WIDTH

NODE=M033210

 $\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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400±100	ALDE	95	GAM2	38 $\pi^- p \rightarrow \omega \pi^0 n$
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NODE=M033W3
NODE=M033W3

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

••• We do not use the following data for averages, fits, limits, etc. •••

~ 169	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
-------	-------	----	------	-------------------------------

~ 250	¹⁰ MARTIN	80B	RVUE	
-------	----------------------	-----	------	--

~ 300	¹⁰ MARTIN	80C	RVUE	
-------	----------------------	-----	------	--

~ 150	¹¹ CARTER	78B	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow K^- K^+$
-------	----------------------	-----	------	---	--

~ 210	¹² CARTER	77	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \pi\pi$
-------	----------------------	----	------	---	---------------------------------------

NODE=M033W1
NODE=M033W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

••• We do not use the following data for averages, fits, limits, etc. •••

260±75	¹³ ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
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235 ⁺ ₄₀ ⁶⁵	ANISOVICH	00J	SPEC	
--	-----------	-----	------	--

135 ⁺ ₆₅ ¹⁵⁰	^{14,15} COUPLAND	77	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
---	---------------------------	----	------	---	---

165 ⁺ ₈ ¹⁸	¹⁵ ALSPECTOR	73	CNTR		$\bar{p}p$ S channel
---	-------------------------	----	------	--	----------------------

< 60	¹⁶ OH	70B	HDBC	-0	$\bar{p}(pn), K^* K 2\pi$
------	------------------	-----	------	----	---------------------------

~ 140	ABRAMS	67C	CNTR		S channel $\bar{p}N$
-------	--------	-----	------	--	----------------------

NODE=M033W2
NODE=M033W2

 $\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

••• We do not use the following data for averages, fits, limits, etc. •••

245±20	ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$
--------	-------	----	------	---	------------------------------------

¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

¹¹ $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis.

¹² $I(J^P) = 1(5^-)$ from amplitude analysis.

¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁴ From a fit to the total elastic cross section.

¹⁵ Isospins 0 and 1 not separated.

¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.

NODE=M033W4
NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
NODE=M033W1;LINKAGE=K
NODE=M033W1;LINKAGE=J
NODE=M033W2;LINKAGE=AY

NODE=M033W2;LINKAGE=E
NODE=M033W2;LINKAGE=I
NODE=M033W2;LINKAGE=N

$\rho_5(2350)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
OH	73	NP B51 57	B.Y. Oh <i>et al.</i>	(MSU)
CHAPMAN	71B	PR D4 1275	J.W. Chapman <i>et al.</i>	(MICH)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
OH	70B	PRL 24 1257	B.Y. Oh <i>et al.</i>	(MSU)
ABRAMS	67C	PRL 18 1209	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M033

REFID=48828
 REFID=48327
 REFID=48349
 REFID=47950
 REFID=44371
 REFID=44103
 REFID=21665
 REFID=21838
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21813
 REFID=21931
 REFID=21926
 REFID=21807
 REFID=21925
 REFID=21804

 $\eta(2370)$

$$J^{PC} = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE
 was $X(2370)$

$J^{PC} = 0^-+$ determined by ABLIKIM 24.

NODE=M247

NODE=M247

 $\eta(2370)$ MASS

NODE=M247M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2377 ± 9 OUR AVERAGE				
[2357 ± 17 MeV OUR 2024 AVERAGE Scale factor = 2.7]				

NODE=M247M

NODE=M247M
 NEW

2395 ± 11 $\begin{smallmatrix} +26 \\ -94 \end{smallmatrix}$ ¹ ABLIKIM 24 BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

2376.3 ± 8.7 $\begin{smallmatrix} +3.2 \\ -4.3 \end{smallmatrix}$ 565 ABLIKIM 11C BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2341.6 ± 6.5 ± 5.7 ² ABLIKIM 20Q BES3 $J/\psi \rightarrow \gamma K \bar{K} \eta'$

¹ Decaying to $f_0(980) \eta'$, fitted together with $X(1835)$, a 600 MeV broad structure around 2.8 GeV, and the tail of the $\eta_c(1S)$. Supersedes ABLIKIM 20Q.

² The state observed by ABLIKIM 11C at 2120 MeV is not observed with 90% CL upper limit of 1.49×10^{-5} for $J/\psi \rightarrow \gamma X(2120) \rightarrow \gamma K^+ K^- \eta'$ and 6.38×10^{-6} for $K_S^0 K_S^0 \eta'$.

NODE=M247M;LINKAGE=B

NODE=M247M;LINKAGE=A

 $\eta(2370)$ WIDTH

NODE=M247W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
148 $\begin{smallmatrix} +80 \\ -28 \end{smallmatrix}$ OUR AVERAGE			
Error includes scale factor of 1.7. [114 $\begin{smallmatrix} +12 \\ -10 \end{smallmatrix}$ MeV OUR 2024 AVERAGE]			

NODE=M247W

NEW

188 $\begin{smallmatrix} +18+124 \\ -17-33 \end{smallmatrix}$ ¹ ABLIKIM 24 BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

83 ± 17 $\begin{smallmatrix} +44 \\ -6 \end{smallmatrix}$ ABLIKIM 11C BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

117 ± 10 ± 8 ² ABLIKIM 20Q BES3 $J/\psi \rightarrow \gamma K \bar{K} \eta'$

¹ Decaying to $f_0(980) \eta'$, fitted together with $X(1835)$, a 600 MeV broad structure around 2.8 GeV, and the tail of the $\eta_c(1S)$. Supersedes ABLIKIM 20Q.

² The state observed by ABLIKIM 11C at 2120 MeV is not observed with 90% CL upper limit of 1.49×10^{-5} for $J/\psi \rightarrow \gamma X(2120) \rightarrow \gamma K^+ K^- \eta'$ and 6.38×10^{-6} for $K_S^0 K_S^0 \eta'$.

NODE=M247W;LINKAGE=B

NODE=M247W;LINKAGE=A

 $\eta(2370)$ DECAY MODES

NODE=M247215;NODE=M247

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^+ K^- \eta'$	seen
Γ_2 $K_S^0 K_S^0 \eta'$	seen
Γ_3 $\pi^+ \pi^- \eta'$	seen
Γ_4 $f_0(980) \eta'$	seen
Γ_5 $\eta \eta \eta'$	not seen

DESIG=1

DESIG=2

DESIG=3

DESIG=5

DESIG=4

$\eta(2370)$ BRANCHING RATIOS

NODE=M247225

 $\Gamma(K^+K^-\eta')/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	20Q	BES3 $J/\psi \rightarrow \gamma K^+ K^- \eta'$

NODE=M247R01
NODE=M247R01 $\Gamma(K_S^0 K_S^0 \eta')/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	20Q	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

NODE=M247R02
NODE=M247R02 $\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	11C	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M247R00
NODE=M247R00 $\Gamma(f_0(980)\eta')/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	24	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

NODE=M247R04
NODE=M247R04 $\Gamma(\eta\eta\eta')/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	21C	BES3 $J/\psi(1S) \rightarrow \gamma \eta \eta \eta'$

NODE=M247R03
NODE=M247R03¹ ABLIKIM 21C measured $B(J/\psi(1S) \rightarrow \gamma \eta(2370) \rightarrow \gamma \eta \eta \eta') < 9.2 \times 10^{-6}$.

NODE=M247R03;LINKAGE=A

 $\eta(2370)$ REFERENCES

NODE=M247

ABLIKIM	24	PRL 132 181901	M. Ablikim <i>et al.</i>	(BESIII Collab.) JPC
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20Q	EPJ C80 746	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)

REFID=62645
REFID=61030
REFID=60457
REFID=53684 $f_0(2470)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M266

OMITTED FROM SUMMARY TABLE

Seen by ABLIKIM 22C with a significance of 5.2σ in a partial-wave analysis of the systems (γX) , $X \rightarrow \eta' \eta'$ and $(\eta' X)$, $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$.

NODE=M266

 $f_0(2470)$ MASS

NODE=M266M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2470 \pm 4_{-6}^{+4}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M266M

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M266M;LINKAGE=A

 $f_0(2470)$ WIDTH

NODE=M266W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$75 \pm 9_{-8}^{+11}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M266W

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M266W;LINKAGE=C

 $f_0(2470)$ DECAY MODES

NODE=M266215;NODE=M266

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta' \eta'$	seen

DESIG=1

$f_0(2470)$ BRANCHING RATIOS $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M266225

NODE=M266R00
NODE=M266R00

NODE=M266R00;LINKAGE=A

 $f_0(2470)$ REFERENCES

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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NODE=M266

REFID=61637

NODE=M089

 $f_6(2510)$

$$I^G(J^{PC}) = 0^+(6^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M089

 $f_6(2510)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2470±50 OUR AVERAGE	Error includes scale factor of 2.1.		

2420±30 ALDE 98 GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$ 2510±30 BINON 84B GAM2 38 $\pi^- p \rightarrow n 2\pi^0$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

2485±40 ¹ ANISOVICH 00J SPEC 1.92–2.41 $p\bar{p}$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M089M

NODE=M089M

NODE=M089M;LINKAGE=AN

 $f_6(2510)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
260±40 OUR AVERAGE			

270±60 ALDE 98 GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$ 240±60 BINON 84B GAM2 38 $\pi^- p \rightarrow n 2\pi^0$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

410±90 ² ANISOVICH 00J SPEC 1.92–2.41 $p\bar{p}$

² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.

NODE=M089W

NODE=M089W

NODE=M089W;LINKAGE=AN

 $f_6(2510)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	(6.0±1.0) %

NODE=M089215;NODE=M089

DESIG=1

 $f_6(2510)$ BRANCHING RATIOS $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.06±0.01	³ BINON	83C	GAM2 38 $\pi^- p \rightarrow n 4\gamma$

³ Assuming one pion exchange and using data of BOLOTOV 74.

NODE=M089220

NODE=M089R1
NODE=M089R1

NODE=M089R1;LINKAGE=A

 $f_6(2510)$ REFERENCES

ANISOVICH 00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
ANISOVICH 99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH 99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
ANISOVICH 99J	PL B471 271	A.V. Anisovich <i>et al.</i>	
ANISOVICH 99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
ALDE 98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also	PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
	Translated from YAF 62 446.		
BINON 84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP) JP
BINON 83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)
	Translated from YAF 38 1199.		
BOLOTOV 74	PL 52B 489	V.N. Bolotov <i>et al.</i>	(SERP)

NODE=M089

REFID=47942

REFID=47950

REFID=46903

REFID=46926

REFID=47416

REFID=47472

REFID=46605

REFID=46914

REFID=21780

REFID=40288

REFID=44705

STRANGE MESONS

($S = \pm 1, C = B = 0$)

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s$, similarly for K^{*} 's

$K_0^*(700)$

$$I(J^P) = \frac{1}{2}(0^+)$$

also known as κ ; was $K_0^*(800)$

See the related review(s):

Scalar Mesons below 1 GeV

$K_0^*(700)$ T-Matrix Pole \sqrt{s}

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(630-730) - i (260-340) OUR ESTIMATE (see Fig. 64.1 in the review)			
$(702 \pm 12^{+4}_{-5}) - i (285 \pm 16^{+8}_{-13})$	¹ DANILKIN	21	RVUE Compilation
$(648 \pm 7) - i (280 \pm 16)$	² PELAEZ	20	RVUE $\pi K \rightarrow \pi K$
$(670 \pm 18) - i (295 \pm 28)$	³ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
$(764 \pm 63^{+71}_{-54}) - i (306 \pm 149^{+143}_{-85})$	⁴ ABLIKIM	11B	BES2 $1.3k J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
$(665 \pm 9) - i (268^{+21}_{-6})$	⁵ GUO	11B	RVUE
$(849 \pm 77^{+18}_{-14}) - i (256 \pm 40^{+46}_{-22})$	⁴ ABLIKIM	10E	BES2 $1.4k J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
$(663 \pm 8 \pm 34) - i (329 \pm 5 \pm 22)$	⁶ BUGG	10	RVUE S-matrix pole
$(706.0 \pm 1.8 \pm 22.8) - i (319.4 \pm 2.2 \pm 20.2)$	⁷ BONVICINI	08A	CLEO $141k D^+ \rightarrow K^- \pi^+ \pi^+$
$(841 \pm 30^{+81}_{-73}) - i (309 \pm 45^{+48}_{-72})$	⁴ ABLIKIM	06C	BES2 $25k J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
$(750^{+30}_{-55}) - i (342 \pm 60)$	⁸ BUGG	06	RVUE
$(658 \pm 13) - i (279 \pm 12)$	⁹ DESCOTES-G.	06	RVUE $\pi K \rightarrow \pi K$
$(757 \pm 33) - i (279 \pm 41)$	¹⁰ GUO	06	RVUE
$(694 \pm 53) - i (303 \pm 30)$	¹¹ ZHOU	06	RVUE $K p \rightarrow K^- \pi^+ n$
$(594 \pm 79) - i (362 \pm 166)$	¹¹ ZHENG	04	RVUE $K^- p \rightarrow K^- \pi^+ n$
$(722 \pm 60) - i (386 \pm 50)$	¹¹ BUGG	03	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$(875 \pm 75) - i (335 \pm 110)$	¹² ISHIDA	97B	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$727 - i 263$	¹³ VANBEVEREN	86	RVUE

¹ Data driven analysis using partial-wave dispersion relations.

² Extracted employing πK partial wave analysis from ESTABROOKS 78 and ASTON 88, Roy-Steiner equations and once subtracted forward dispersion relations.

³ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

⁴ Extracted from Breit-Wigner parameters.

⁵ Fit to scattering phase shifts using UChPT amplitudes with explicit resonances.

⁶ Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06c, AITALA 06, and LINK 09 using an s -dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.

⁷ From a complex pole included in the fit. Using parameters from the model that fits data best.

⁸ Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06c using for the κ an s -dependent width with an Adler zero near threshold.

⁹ Using Roy-Steiner equations (ROY 71) consistent with unitarity, analyticity and crossing symmetry constraints.

¹⁰ From UChPT fitted to MERCER 71, BINGHAM 72 and ESTABROOKS 78. Amplitude shown to be consistent with data of ABLIKIM 06c.

¹¹ Reanalysis of ASTON 88 data.

¹² Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes. Extracted from Breit-Wigner parameters.

¹³ Unitarized Quark Model.

NODE=MXXX020

NODE=MXXX020

NODE=M174

NODE=M174TMP

NODE=M174TMP

→ UNCHECKED ←

NODE=M174TMP;LINKAGE=P

NODE=M174TMP;LINKAGE=J

NODE=M174TMP;LINKAGE=N

NODE=M174TMP;LINKAGE=A

NODE=M174TMP;LINKAGE=D

NODE=M174TMP;LINKAGE=H

NODE=M174TMP;LINKAGE=B

NODE=M174TMP;LINKAGE=G

NODE=M174TMP;LINKAGE=I

NODE=M174TMP;LINKAGE=O

NODE=M174TMP;LINKAGE=F

NODE=M174TMP;LINKAGE=M

NODE=M174TMP;LINKAGE=E

$K_0^*(700)$ Breit-Wigner Mass

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
838 ± 11 OUR AVERAGE [845 ± 17 MeV OUR 2024 AVERAGE]				
833 ± 15		¹ ACHARYA	24C ALCE	$pp \rightarrow K_S^0 \pi^\pm X$, 13 TeV
826 ± 49 $^{+49}_{-34}$	1.3k	² ABLIKIM	11B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
810 ± 68 $^{+15}_{-24}$	1.4k	³ ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
856 ± 17 ± 13	54k	LINK	07B FOCUS	$D^+ \rightarrow K^- \pi^+ \pi^+$
878 ± 23 $^{+64}_{-55}$	25k	⁴ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
797 ± 19 ± 43	15k	^{5,6} AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
888.0 ± 1.9	141k	⁷ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
855 ± 15	0.6k	⁸ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
905 $^{+65}_{-30}$		⁹ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174M
 NODE=M174M
 NEW

¹ Assuming a Gaussian source to the measured two-particle correlation function. Systematic error dominates. For 0–100% multiplicity class.

² The Breit-Wigner parameters from a fit with seven intermediate resonances. The S -matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

³ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

⁴ A fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(700)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ decay studied by EPIFANOV 07. Averaged value from different parameterizations.

⁵ Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(700)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

⁶ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

⁷ Using parameters from the model that fits data best.

⁸ Breit-Wigner parameters. A significant S -wave can be also modeled as a non-resonant contribution.

⁹ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

NODE=M174M;LINKAGE=D

NODE=M174M;LINKAGE=LI

NODE=M174M;LINKAGE=BL

NODE=M174M;LINKAGE=EP

NODE=M174M;LINKAGE=A

NODE=M174M;LINKAGE=AU

NODE=M174M;LINKAGE=C

NODE=M174M;LINKAGE=CA

NODE=M174M;LINKAGE=IS

 $K_0^*(700)$ Breit-Wigner Width

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
463 ± 27 OUR AVERAGE [468 ± 30 MeV OUR 2024 AVERAGE]				
430 $^{+88}_{-53}$		¹ ACHARYA	24C ALCE	$pp \rightarrow K_S^0 \pi^\pm X$, 13 TeV
449 ± 156 $^{+144}_{-81}$	1.3k	² ABLIKIM	11B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
536 ± 87 $^{+106}_{-47}$	1.4k	³ ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
464 ± 28 ± 22	54k	LINK	07B FOCUS	$D^+ \rightarrow K^- \pi^+ \pi^+$
499 ± 52 $^{+55}_{-87}$	25k	⁴ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
410 ± 43 ± 87	15k	^{5,6} AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
550.4 ± 11.8	141k	⁷ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
251 ± 48	0.6k	⁸ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
545 $^{+235}_{-110}$		⁹ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174W

NODE=M174W

NEW

¹ Assuming a Gaussian source to the measured two-particle correlation function. Systematic error dominates. For 0–100% multiplicity class.

² The Breit-Wigner parameters from a fit with seven intermediate resonances. The S -matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

³ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

⁴ A fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(700)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ decay studied by EPIFANOV 07. Averaged value from different parameterizations.

NODE=M174W;LINKAGE=D

NODE=M174W;LINKAGE=LI

NODE=M174W;LINKAGE=BL

NODE=M174W;LINKAGE=EP

- ⁵ Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(700)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.
- ⁶ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.
- ⁷ Using parameters from the model that fits data best.
- ⁸ Statistical error only. A fit to the Dalitz plot including the $K_0^*(700)^\pm$, $K^*(892)^\pm$, and ϕ resonances modeled as Breit-Wigners. A significant S -wave can be also modeled as a non-resonant contribution.
- ⁹ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

NODE=M174W;LINKAGE=A

NODE=M174W;LINKAGE=AU

NODE=M174W;LINKAGE=C

NODE=M174W;LINKAGE=CA

NODE=M174W;LINKAGE=IS

NODE=M174215;NODE=M174

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M174

REFID=63181
 REFID=62088
 REFID=60559
 REFID=57836
 REFID=53683
 REFID=58808
 REFID=53361
 REFID=53213
 REFID=53056
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 REFID=51153
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 REFID=51198
 REFID=50679
 REFID=50165
 REFID=49586
 REFID=48807
 REFID=48728
 REFID=48134
 REFID=48655
 REFID=40262
 REFID=45769
 REFID=22443
 REFID=22415
 REFID=22412
 REFID=51107

$K_0^*(700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	100 %

$K_0^*(700)$ REFERENCES

ACHARYA 24C	PL B856 138915	S. Acharya <i>et al.</i>	(ALICE Collab.)
DANILKIN 21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen	(MAINZ)
PELAEZ 20	PRL 124 172001	J.R. Pelaez <i>et al.</i>	
PELAEZ 17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
ABLIKIM 11B	PL B698 183	M. Ablikim <i>et al.</i>	(BES II Collab.)
GUO 11B	PR D84 034005	Z.-H. Guo, J.A. Oller	
ABLIKIM 10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)
BUGG 10	PR D81 014002	D.V. Bugg	(LOQM)
LINK 09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI 08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT 07T	PR D76 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)
EPIFANOV 07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
LINK 07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM 06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA 06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also	PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BUGG 06	PL B632 471	D.V. Bugg	(LOQM)
CRAWFIELD 06A	PR D74 031108	C. Cawfield <i>et al.</i>	(CLEO Collab.)
DESCOTES-G... 06	EPJ C48 553	S. Descotes-Genon, B. Moussallam	
GUO 06	NP A773 78	F.K. Guo <i>et al.</i>	
ZHOU 06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
LINK 05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ZHENG 04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG 03	PL B572 1	D.V. Bugg	
AITALA 02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
LINK 02E	PL B535 43	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
KOPP 01	PR D63 092001	S. Kopp <i>et al.</i>	(CLEO Collab.)
ISHIDA 97B	PTP 98 621	S. Ishida <i>et al.</i>	
ASTON 88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
VANBEVEREN 86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)
ESTABROOKS 78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
BINGHAM 72	NP B41 1	H.H. Bingham <i>et al.</i>	(International K^+ Collab.)
MERCER 71	NP B32 381	R. Mercer <i>et al.</i>	(JHU)
ROY 71	PL 36B 353	S.M. Roy	

$K^*(892)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M018

 $K^*(892)$ T-Matrix Pole \sqrt{s}

NODE=M018TMP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(890 ± 14) - i (26 ± 6) OUR ESTIMATE			
(890 ± 2) - i (25.6 ± 1.2)	¹ PELAEZ	20	RVUE $\pi K \rightarrow \pi K$
(892 ± 1) - i (29 ± 1)	² PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
(889 ± 13) - i (24 ± 4)	³ PELAEZ	04A	RVUE $\pi K \rightarrow \pi K$

NODE=M018TMP

→ UNCHECKED ←

OCCUR=2

¹ Extracted employing πK partial wave analysis from ESTABROOKS 78 and ASTON 88, Roy-Steiner equations and once subtracted forward dispersion relations.

NODE=M018TMP;LINKAGE=A

² Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M018TMP;LINKAGE=E

³ Reanalysis of data from ESTABROOKS 78 and ASTON 88 in the unitarized ChPT model.

NODE=M018TMP;LINKAGE=B

 $K^*(892)$ MASS

NODE=M018205

CHARGED ONLY, HADROPRODUCEDNODE=M018M1
NODE=M018M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
891.67 ± 0.26 OUR AVERAGE					
892.2 ± 0.5 ± 1.7		ALBRECHT	20	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
892.6 ± 0.5	5840	BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
888 ± 3		NAPIER	84	SPEC +	200 $\pi^- p \rightarrow 2K_S^0 X$
891 ± 1		NAPIER	84	SPEC -	200 $\pi^- p \rightarrow 2K_S^0 X$
891.7 ± 2.1	3700	BARTH	83	HBC +	70 $K^+ p \rightarrow K^0 \pi^+ X$
891 ± 1	4100	TOAFF	81	HBC -	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.8 ± 1.6		AJINENKO	80	HBC +	32 $K^+ p \rightarrow K^0 \pi^+ X$
890.7 ± 0.9	1800	AGUILAR-...	78B	HBC ±	0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
886.6 ± 2.4	1225	BALAND	78	HBC ±	12 $\bar{p}p \rightarrow (K\pi)^\pm X$
891.7 ± 0.6	6706	COOPER	78	HBC ±	0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
891.9 ± 0.7	9000	¹ PALER	75	HBC -	14.3 $K^- p \rightarrow (K\pi)^- X$
892.2 ± 1.5	4404	AGUILAR-...	71B	HBC -	3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
891 ± 2	1000	CRENNELL	69D	DBC -	3.9 $K^- N \rightarrow K^0 \pi^- X$
890 ± 3.0	720	BARLOW	67	HBC ±	1.2 $\bar{p}p \rightarrow (K^0 \pi)^\pm K^\mp$
889 ± 3.0	600	BARLOW	67	HBC ±	1.2 $\bar{p}p \rightarrow (K^0 \pi)^\pm K\pi$
891 ± 2.3	620	² DEBAERE	67B	HBC +	3.5 $K^+ p \rightarrow K^0 \pi^+ p$
891.0 ± 1.2	1700	³ WOJCICKI	64	HBC -	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

893.6 ± 0.1 $^{+0.2}_{-0.3}$	183k	ABLIKIM	19AQ	BES ±	$J/\psi \rightarrow K^+ K^- \pi^0$
895.6 ± 0.8	4k	⁴ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
893.2 ± 0.1 ± 1.0	190k	⁵ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
893.5 ± 1.1	27k	⁶ ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
890.4 ± 0.2 ± 0.5	80k	⁷ BIRD	89	LASS -	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
890.0 ± 2.3	800	^{2,3} CLELAND	82	SPEC +	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
896.0 ± 1.1	3200	^{2,3} CLELAND	82	SPEC +	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
893 ± 1	3600	^{2,3} CLELAND	82	SPEC -	50 $K^+ p \rightarrow K_S^0 \pi^- p$
896.0 ± 1.9	380	DELFOSSÉ	81	SPEC +	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ± 2.3	187	DELFOSSÉ	81	SPEC -	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ± 2.0	765	² CLARK	73	HBC -	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ± 1.5	1150	^{2,3} CLARK	73	HBC -	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ± 2.6	341	² SCHWEING...68	68	HBC -	5.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

¹ Inclusive reaction. Complicated background and phase-space effects.

NODE=M018M;LINKAGE=I

² Mass errors enlarged by us to Γ/\sqrt{N} . See note.

NODE=M018M;LINKAGE=D

³ Number of events in peak reevaluated by us.

NODE=M018M;LINKAGE=W

⁴ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.

NODE=M018M1;LINKAGE=B

⁵ Average of fit results with different parametrizations for the $K\pi$ S-wave.

NODE=M018M1;LINKAGE=A

⁶ K-matrix pole.

NODE=M018M1;LINKAGE=AN

⁷ From a partial wave amplitude analysis.

NODE=M018M1;LINKAGE=F

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
895.47 ± 0.20 ± 0.74	53k	¹ EPIFANOV	07	BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
892.0 ± 0.5		² BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 ± 0.9		^{3,4} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 ± 0.2		^{4,5} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 ± 0.9	12k	⁶ BONVICINI	02	CLEO $\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 ± 2		⁷ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

¹ From a fit in the $K_S^*(700) + K^*(892) + K^*(1410)$ model.

² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.

⁶ Calculated by us from the shift by 4.7 ± 0.9 MeV (statistical uncertainty only) reported in BONVICINI 02 with respect to the world average value from PDG 00.

⁷ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

NODE=M018MCT
NODE=M018MCT

NODE=M018MCT;LINKAGE=EF
NODE=M018MCT;LINKAGE=BT

NODE=M018MCT;LINKAGE=BI

NODE=M018MCT;LINKAGE=NS
NODE=M018MCT;LINKAGE=JA
NODE=M018MCT;LINKAGE=BO

NODE=M018MCT;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
895.55 ± 0.20 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
894.68 ± 0.25 ± 0.05		¹ ABLIKIM	16F	BES3 $D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.4 ± 0.2 ± 0.2	243k	² DEL-AMO-SA..11i	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 ± 0.2 ± 0.3	141k	³ BONVICINI	08A	CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
895.41 ± 0.32 ^{+0.35} _{-0.43}	18k	⁴ LINK	05i	FOCS $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 ± 2		BARBERIS	98E	OMEG 450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 ± 0.5 ± 0.2		ASTON	88	LASS 11 $K^- p \rightarrow K^- \pi^+ n$
894.52 ± 0.63	25k	⁵ ATKINSON	86	OMEG 20-70 γp
894.63 ± 0.76	20k	⁵ ATKINSON	86	OMEG 20-70 γp
897 ± 1	28k	EVANGELIS...	80	OMEG 10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
898.4 ± 1.4	1180	AGUILAR-...	78B	HBC 0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
894.9 ± 1.6		WICKLUND	78	ASPK 3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
897.6 ± 0.9		BOWLER	77	DBC 5.4 $K^+ d \rightarrow K^+ \pi^- p p$
895.5 ± 1.0	3600	MCCUBBIN	75	HBC 3.6 $K^- p \rightarrow K^- \pi^+ n$
897.1 ± 0.7	22k	⁵ PALER	75	HBC 14.3 $K^- p \rightarrow (K\pi)^0 X$
896.0 ± 0.6	10k	FOX	74	RVUE 2 $K^- p \rightarrow K^- \pi^+ n$
896.0 ± 0.6		FOX	74	RVUE 2 $K^+ n \rightarrow K^+ \pi^- p$
896 ± 2		⁶ MATISON	74	HBC 12 $K^+ p \rightarrow K^+ \pi^- \Delta$
896 ± 1	3186	LEWIS	73	HBC 2.1-2.7 $K^+ p \rightarrow K \pi \pi p$
894.0 ± 1.3		⁶ LINGLIN	73	HBC 2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$
898.4 ± 1.3	1700	⁷ BUCHNER	72	DBC 4.6 $K^+ n \rightarrow K^+ \pi^- p$
897.9 ± 1.1	2934	⁷ AGUILAR-...	71B	HBC 3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
898.0 ± 0.7	5362	⁷ AGUILAR-...	71B	HBC 3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
895 ± 1	4300	⁸ HABER	70	DBC 3 $K^- N \rightarrow K^- \pi^+ X$
893.7 ± 2.0	10k	DAVIS	69	HBC 12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
894.7 ± 1.4	1040	⁷ DAUBER	67B	HBC 2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
895.50 ± 0.92 ± 2.6		⁹ ADUSZKIEW...20A	NA61	158 pp
898.1 ± 1.0	4k	¹⁰ LEES	17C	BABR $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
895.53 ± 0.17		LEES	13F	BABR $D^+ \rightarrow K^+ K^- \pi^+$
894.9 ± 0.5 ± 0.7	14.4k	¹¹ MITCHELL	09A	CLEO $D_s^+ \rightarrow K^+ K^- \pi^+$
896.2 ± 0.3	20k	¹² AUBERT	07AK	BABR 10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$
900.7 ± 1.1	5900	BARTH	83	HBC 70 $K^+ p \rightarrow K^+ \pi^- X$

¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.

² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

³ From the isobar model with a complex pole for the κ .

⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

⁵ Inclusive reaction. Complicated background and phase-space effects.

⁶ From pole extrapolation.

⁷ Mass errors enlarged by us to Γ/\sqrt{N} . See note.

NODE=M018M2
NODE=M018M2

OCCUR=2

OCCUR=2

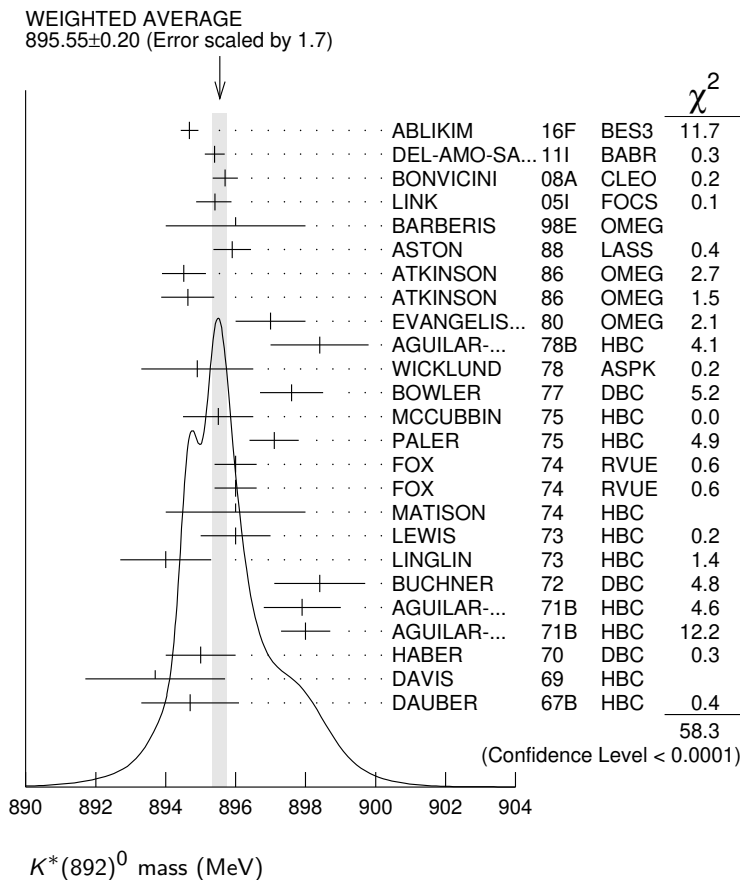
OCCUR=2

NODE=M018M2;LINKAGE=B
NODE=M018M2;LINKAGE=DE
NODE=M018M2;LINKAGE=BO
NODE=M018M2;LINKAGE=LI
NODE=M018M2;LINKAGE=I
NODE=M018M2;LINKAGE=C
NODE=M018M2;LINKAGE=D

- ⁸Number of events in peak reevaluated by us.
- ⁹For transverse momenta between 0.6 and 0.8 GeV/c and rapidity $0 < y < 0.5$.
- ¹⁰From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.
- ¹¹This value comes from a fit with χ^2 of 178/117.
- ¹²Systematic uncertainties not estimated.

NODE=M018M2;LINKAGE=W
 NODE=M018M2;LINKAGE=C
 NODE=M018M2;LINKAGE=A

 NODE=M018M2;LINKAGE=MI
 NODE=M018M2;LINKAGE=NS



NODE=M018209

$K^*(892)$ MASSES AND MASS DIFFERENCES

Unrealistically small errors have been reported by some experiments. We use simple “realistic” tests for the minimum errors on the determination of a mass and width from a sample of N events:

$$\delta_{\min}(m) = \frac{\Gamma}{\sqrt{N}}, \quad \delta_{\min}(\Gamma) = 4 \frac{\Gamma}{\sqrt{N}}. \quad (1)$$

We consistently increase unrealistic errors before averaging. For a detailed discussion, see the 1971 edition of this Note.

$m_{K^*(892)^0} = m_{K^*(892)^\pm}$							
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT		
6.7±1.2 OUR AVERAGE							
7.7±1.7	2980	AGUILAR...	78B	HBC	±0	0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$	NODE=M018D
5.7±1.7	7338	AGUILAR...	71B	HBC	-0	3.9,4.6 $K^- p$	NODE=M018D
6.3±4.1	283	¹ BARASH	67B	HBC		0.0 $\bar{p}p$	

¹ Number of events in peak reevaluated by us.

NODE=M018D;LINKAGE=W

K*(892) RANGE PARAMETER

NODE=M018R

All from partial wave amplitude analyses.

NODE=M018R

VALUE (GeV ⁻¹)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2.1 ±0.5 ±0.5	243k	¹ DEL-AMO-SA.11I	BABR	0	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
3.96 ±0.54 ^{+1.31} _{-0.90}	18k	² LINK	05I	FOCS	0 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
3.4 ±0.7		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
12.1 ±3.2 ±3.0		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M018R

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

NODE=M018R;LINKAGE=DE

² Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

NODE=M018R;LINKAGE=L

K*(892) WIDTH

NODE=M018215

CHARGED ONLY, HADROPRODUCED

NODE=M018W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
51.4 ±0.8 OUR FIT					
51.4 ±0.8 OUR AVERAGE					
54.4 ±0.9 ±1.7		ALBRECHT	20	CBAR	0.9 $\bar{p} p \rightarrow K^+ K^- \pi^0$
49 ±2	5840	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
56 ±4		NAPIER	84	SPEC	- 200 $\pi^- p \rightarrow 2K_S^0 X$
51 ±2	4100	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
50.5 ±5.6		AJINENKO	80	HBC	+ 32 $K^+ p \rightarrow K^0 \pi^+ X$
45.8 ±3.6	1800	AGUILAR-...	78B	HBC	± 0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
52.0 ±2.5	6706	¹ COOPER	78	HBC	± 0.76 $\bar{p} p \rightarrow (K\pi)^\pm X$
52.1 ±2.2	9000	² PALER	75	HBC	- 14.3 $K^- p \rightarrow (K\pi)^- X$
46.3 ±6.7	765	¹ CLARK	73	HBC	- 3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2 ±5.7	1150	^{1,3} CLARK	73	HBC	- 3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3 ±3.3	4404	¹ AGUILAR-...	71B	HBC	- 3.9, 4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{1,3} WOJCICKI	64	HBC	- 1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M018W1

NODE=M018W1

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

46.7 ±0.2 ^{+0.1} _{-0.2}	183k	ABLIKIM	19AQ	BES	± $J/\psi \rightarrow K^+ K^- \pi^0$
43.6 ±1.3	4k	⁴ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
47.2 ±0.3 ±2.3	190k	⁵ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
54.8 ±1.7	27k	⁶ ABELE	99D	CBAR	± 0.0 $\bar{p} p \rightarrow K^+ K^- \pi^0$
45.2 ±1 ±2	80k	⁷ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
42.8 ±7.1	3700	BARTH	83	HBC	+ 70 $K^+ p \rightarrow K^0 \pi^+ X$
64.0 ±9.2	800	^{1,3} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0 ±4.4	3200	^{1,3} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{1,3} CLELAND	82	SPEC	- 50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6 ±3.8	380	DELFOSSÉ	81	SPEC	+ 50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5 ±3.9	187	DELFOSSÉ	81	SPEC	- 50 $K^\pm p \rightarrow K^\pm \pi^0 p$

NODE=M018W;LINKAGE=D

NODE=M018W;LINKAGE=I

NODE=M018W;LINKAGE=W

NODE=M018W1;LINKAGE=B

NODE=M018W1;LINKAGE=A

NODE=M018W1;LINKAGE=AN

NODE=M018W1;LINKAGE=F

¹ Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.² Inclusive reaction. Complicated background and phase-space effects.³ Number of events in peak reevaluated by us.⁴ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.⁵ Average of fit results with different parametrizations for the $K\pi$ S -wave.⁶ K -matrix pole.⁷ From a partial wave amplitude analysis.**CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS**

NODE=M018W5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.2 ±0.6 ±1.2	53k	¹ EPIFANOV	07	BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.5 ±1.1		² BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2 ±0.4		^{3,4} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5 ±0.4		^{4,5} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 ±8		⁶ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

NODE=M018W5

• • • We do not use the following data for averages, fits, limits, etc. • • •

- ¹ From a fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model.
² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.
³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
⁴ Systematic uncertainties not estimated.
⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.
⁶ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

NODE=M018W5;LINKAGE=EF
 NODE=M018W5;LINKAGE=BT
 NODE=M018W5;LINKAGE=BI
 NODE=M018W5;LINKAGE=NS
 NODE=M018W5;LINKAGE=JA
 NODE=M018W5;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
47.3 ±0.5 OUR FIT		Error includes scale factor of 2.0.		
47.3 ±0.5 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
46.53 ±0.56 ±0.31		¹ ABLIKIM 16F	BES3	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
46.5 ±0.3 ±0.2	243k	² DEL-AMO-SA..11i	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 ±0.5 ±0.6	141k	³ BONVICINI 08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 ±0.86 $^{+1.32}_{-1.06}$	18k	⁴ LINK 05i	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 ±3		BARBERIS 98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 ±0.8 ±0.9		ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
46.5 ±4.3	5900	BARTH 83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$
54 ±2	28k	EVANGELIS... 80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 ±4.8	1180	AGUILAR-... 78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 ±1.7		WICKLUND 78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 ±2.5		BOWLER 77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$
48 $^{+3}_{-2}$	3600	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
50.6 ±2.5	22k	⁵ PALER 75	HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$
47 ±2	10k	FOX 74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$
51 ±2		FOX 74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$
46.0 ±3.3	3186	⁶ LEWIS 73	HBC	2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 ±5.0	1700	⁶ BUCHNER 72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
55.8 $^{+4.2}_{-3.4}$	2934	⁶ AGUILAR-... 71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
48.5 ±2.7	5362	AGUILAR-... 71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ \pi^- p$
54.0 ±3.3	4300	^{6,7} HABER 70	DBC	3 $K^- N \rightarrow K^- \pi^+ X$
53.2 ±2.1	10k	⁶ DAVIS 69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 ±5.5	1040	⁶ DAUBER 67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
48.8 ±1.8 ±2.0		⁸ ADUSZKIEW...20A	NA61	158 pp
52.6 ±1.7	4k	⁹ LEES 17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
44.90 ±0.30		LEES 13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$
45.7 ±1.1 ±0.5	14.4k	¹⁰ MITCHELL 09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 ±0.9	20k	¹¹ AUBERT 07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$

NODE=M018W2
 NODE=M018W2

OCCUR=2

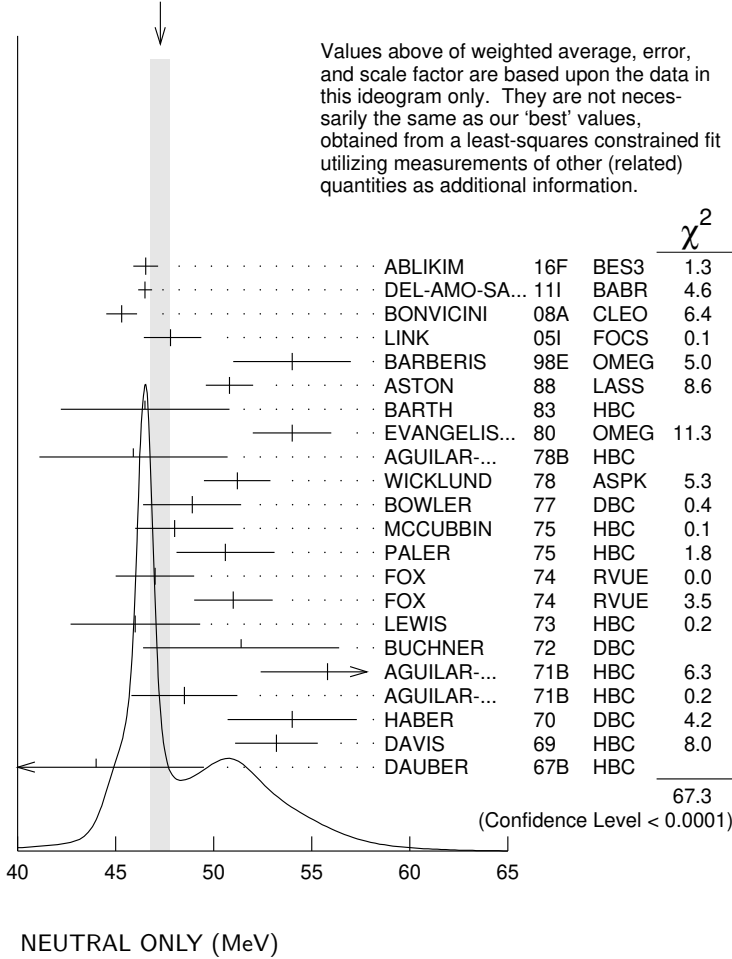
OCCUR=2

- ¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.
² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).
³ From the isobar model with a complex pole for the κ .
⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.
⁵ Inclusive reaction. Complicated background and phase-space effects.
⁶ Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.
⁷ Number of events in peak reevaluated by us.
⁸ For transverse momenta between 0.6 and 0.8 GeV/c and rapidity $0 < y < 0.5$.
⁹ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.
¹⁰ This value comes from a fit with χ^2 of 178/117.
¹¹ Systematic uncertainties not estimated.

NODE=M018W2;LINKAGE=B
 NODE=M018W2;LINKAGE=DE
 NODE=M018W2;LINKAGE=BO
 NODE=M018W2;LINKAGE=LN
 NODE=M018W2;LINKAGE=I
 NODE=M018W2;LINKAGE=D
 NODE=M018W2;LINKAGE=W
 NODE=M018W2;LINKAGE=C
 NODE=M018W2;LINKAGE=A

NODE=M018W2;LINKAGE=MI
 NODE=M018W2;LINKAGE=NS

WEIGHTED AVERAGE
47.3±0.5 (Error scaled by 2.0)



K*(892) DECAY MODES

NODE=M018220;NODE=M018

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\pi$	~ 100	%
Γ_2 $(K\pi)^\pm$	(99.902 ± 0.009) %	
Γ_3 $(K\pi)^0$	(99.754 ± 0.021) %	
Γ_4 $K^0\gamma$	$(2.46 \pm 0.21) \times 10^{-3}$	
Γ_5 $K^\pm\gamma$	$(9.8 \pm 0.9) \times 10^{-4}$	
Γ_6 $K\pi\pi$	< 7	$\times 10^{-4}$ 95%

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=11
DESIG=12
DESIG=4
DESIG=3
DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 14 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 10.7$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	-100	
Γ	17	-17
	x_2	x_5

Mode	Rate (MeV)
Γ_2 $(K\pi)^\pm$	51.4 ± 0.8
Γ_5 $K^\pm\gamma$	0.050 ± 0.005

DESIG=11
DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 23 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 68.4$ for 21 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_4	-100	
Γ	13	-13
	x_3	x_4

Mode	Rate (MeV)	Scale factor
Γ_3 ($K\pi^0$)	47.2 \pm 0.5	2.0
Γ_4 ($K^0\gamma$)	0.117 \pm 0.010	

DESIG=12

DESIG=4

$K^*(892)$ PARTIAL WIDTHS

NODE=M018225

$\Gamma(K^0\gamma)$	Γ_4					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
116 \pm 10 OUR FIT						
116.5 \pm 9.9	584	CARLSMITH	86	SPEC	0	$K_L^0 A \rightarrow K_S^0 \pi^0 A$

NODE=M018W4
NODE=M018W4

$\Gamma(K^\pm\gamma)$	Γ_5				
VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT	
50 \pm 5 OUR FIT					
50 \pm 5 OUR AVERAGE					
48 \pm 11	BERG	83	SPEC	-	156 $K^- A \rightarrow \bar{K} \pi A$
51 \pm 5	CHANDLEE	83	SPEC	+	200 $K^+ A \rightarrow K \pi A$

NODE=M018W3
NODE=M018W3

$K^*(892)$ BRANCHING RATIOS

NODE=M018230

$\Gamma(K^0\gamma)/\Gamma_{\text{total}}$	Γ_4/Γ				
VALUE (units 10^{-3})	DOCUMENT ID	TECN	CHG	COMMENT	
2.46 \pm 0.21 OUR FIT					
1.5 \pm 0.7	CARITHERS	75B	CNTR	0	8-16 $\bar{K}^0 A$

NODE=M018R3
NODE=M018R3

$\Gamma(K^\pm\gamma)/\Gamma_{\text{total}}$	Γ_5/Γ					
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
0.98 \pm 0.09 OUR FIT						
<1.6	95	BEMPORAD	73	CNTR	+	10-16 $K^+ A$

NODE=M018R2
NODE=M018R2

$\Gamma(K\pi\pi)/\Gamma((K\pi)^\pm)$	Γ_6/Γ_2					
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
< 7 \times 10⁻⁴	95	JONGEJANS	78	HBC	4 $K^- p \rightarrow p \bar{K}^0 2\pi$	
<20 \times 10 ⁻⁴		WOJCICKI	64	HBC	-	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M018R1
NODE=M018R1

$K^*(892)$ REFERENCES

NODE=M018

ADUSZKIEW... 20A	EPJ C80 460	A. Aduszkiewicz <i>et al.</i>	(CERN NA61 Collab.)	REFID=60631
ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
PELAEZ 20	PRL 124 172001	J.R. Pelaez <i>et al.</i>		REFID=60559
ABLIKIM 19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
LEES 17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
PELAEZ 17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
AAIJ 16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM 16F	PR D94 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57307
LEES 13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55127
DEL-AMO-SA... 11I	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16493
ANTONELLI 10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)	REFID=53448
BOITO 10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)	REFID=53632
BOITO 09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin		REFID=52728

MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52756
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=52426
JAMIN	08	PL B664 78	M. Jamin, A. Pich, J. Portoles		REFID=52285
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)	REFID=51929
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=50679
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
BONVICINI	02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=48701
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47366
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46348
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
CARLSMITH	86	PRL 56 18	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=22461
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
NAPIER	84	PL 149B 514	A. Napier <i>et al.</i>	(TUFTS, ARIZ, FNAL, FLOR+)	REFID=22460
BARTH	83	NP B223 296	M. Barth <i>et al.</i>	(BRUX, CERN, GENO, MONS+)	REFID=22456
BERG	83	Thesis UMI 83-21652	D.M. Berg	(ROCH)	REFID=22457
CHANDLEE	83	PRL 51 168	C. Handlee <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=22458
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
DELFOSSÉ	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
AJINENKO	80	ZPHY C5 177	I.V. Ajinenko <i>et al.</i>	(SERP, BRUX, MONS+)	REFID=22449
EVANGELIS...	80	NP B165 383	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=22450
AGUILAR-...	78B	NP B141 101	M. Aguilar-Benitez <i>et al.</i>	(MADR, TATA+)	REFID=22438
BALAND	78	NP B140 220	J.F. Baland <i>et al.</i>	(MONS, BELG, CERN+)	REFID=20369
COOPER	78	NP B136 365	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=22441
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJM+)	REFID=22445
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
CARITHERS	75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGI)	REFID=22433
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
PALER	75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)	REFID=22435
FOX	74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)	REFID=22430
MATISON	74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)	REFID=22431
BEMPORAD	73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)	REFID=22416
CLARK	73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)	REFID=22426
LEWIS	73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)	REFID=22427
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
BUCHNER	72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)	REFID=22418
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
HABER	70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)	REFID=22406
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)	REFID=22400
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)	REFID=20160
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)	REFID=20041
DAUBER	67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)	REFID=22389
DEBAERE	67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)	REFID=22390
WOJCICKI	64	PR 135 B484	S.G. Wojcicki	(LRL)	REFID=22379

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

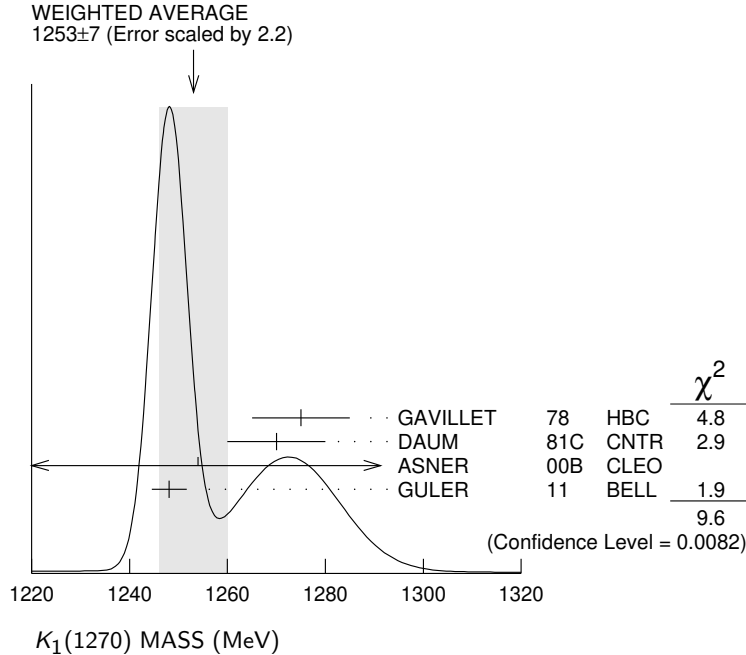
NODE=M028

 $K_1(1270)$ MASS

NODE=M028MX

NODE=M028MX

VALUE (MeV) _____ DOCUMENT ID _____

1253±7 OUR AVERAGE Includes data from the 4 datablocks that follow this one. Error includes scale factor of 2.2. See the ideogram below.**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**NODE=M028M2
NODE=M028M2

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____

The data in this block is included in the average printed for a previous datablock.

1275±10 700 GAVILLET 78 HBC + 4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$ **PRODUCED BY K BEAMS**NODE=M028M3
NODE=M028M3

VALUE (MeV) _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____

The data in this block is included in the average printed for a previous datablock.

1270±10 ¹ DAUM 81C CNTR - 63 $K^- p \rightarrow K^- 2\pi p$

••• We do not use the following data for averages, fits, limits, etc. •••

~ 1276 ² TORNQVIST 82B RVUE

~ 1300 VERGEEST 79 HBC - 4.2 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$

1289±25 ³ CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

~ 1300 BRANDENB... 76 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

~ 1270 OTTER 76 HBC - 10,14,16 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$

1260 DAVIS 72 HBC + 12 $K^+ p$

1234±12 FIRESTONE 72B DBC + 12 $K^+ d$

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.² From a unitarized quark-model calculation.³ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028M3;LINKAGE=DA

NODE=M028M3;LINKAGE=T

NODE=M028M3;LINKAGE=E

PRODUCED BY BEAMS OTHER THAN K MESONSNODE=M028M1
NODE=M028M1

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ COMMENT _____

The data in this block is included in the average printed for a previous datablock.

1248.1 ± 3.3 ± 1.4 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1289.81 ± 0.56 ± 1.66	894k	AAIJ	18A1	LHCB	$D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
1279 ± 10	25k	¹ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
1294 ± 10	310	RODEBACK	81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$
1300	40	CRENNELL	72	HBC	$4.5 \pi^- p \rightarrow \Lambda K 2\pi$
1242 +9 -10		² ASTIER	69	HBC	$\bar{p} p$
1300	45	CRENNELL	67	HBC	$6 \pi^- p \rightarrow \Lambda K 2\pi$

¹ Systematic errors not estimated.
² This was called the C meson.

NODE=M028M1;LINKAGE=AB
 NODE=M028M1;LINKAGE=A

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

NODE=M028MT
 NODE=M028MT

1254 ± 33 ± 34	7k	ASNER	00B	CLEO	$\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
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$K_1(1270)$ WIDTH

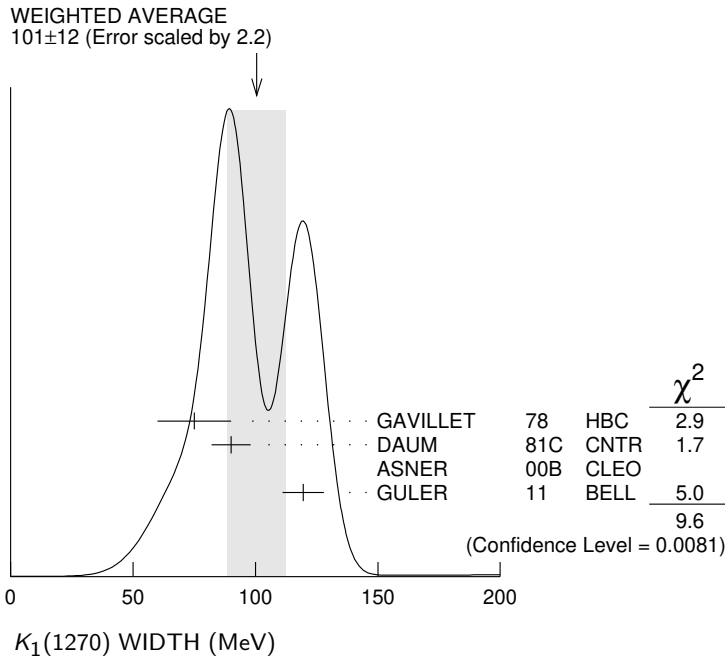
NODE=M028WX

VALUE (MeV)	DOCUMENT ID
-------------	-------------

90 ± 20 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M028WX
 → UNCHECKED ←

101 ± 12 OUR AVERAGE Includes data from the 4 datablocks that follow this one. Error includes scale factor of 2.2. See the ideogram below.



PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE

NODE=M028W2
 NODE=M028W2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
-------------	------	-------------	------	-----	---------

The data in this block is included in the average printed for a previous datablock.

75 ± 15	700	GAVILLET	78	HBC	$4.2 K^- p \rightarrow \Xi^- K \pi \pi$
----------------	-----	----------	----	-----	---

PRODUCED BY K BEAMS

NODE=M028W3
 NODE=M028W3

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

The data in this block is included in the average printed for a previous datablock.

90 ± 8	¹ DAUM	81C	CNTR	-	63 $K^- p \rightarrow K^- 2\pi p$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 150	VERGEEST	79	HBC	-	$4.2 K^- p \rightarrow (\bar{K} \pi \pi)^- p$
150 ± 71	² CARNEGIE	77	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
~ 200	BRANDENB...	76	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$
120	DAVIS	72	HBC	+	$12 K^+ p$
188 ± 21	FIRESTONE	72B	DBC	+	$12 K^+ d$

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.

NODE=M028W3;LINKAGE=DA

² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028W3;LINKAGE=E

PRODUCED BY BEAMS OTHER THAN K MESONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

The data in this block is included in the average printed for a previous datablock.

119.5 ± 5.2 ± 6.7		GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

116.11 ± 1.65 ± 2.96	894k	AAIJ	18A1	LHCB	$D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
131 ± 21	25k	¹ ABLIIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
66 ± 15	310	RODEBACK	81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$
60	40	CRENNELL	72	HBC	$4.5 \pi^- p \rightarrow \Lambda K 2\pi$
127 ⁺⁷ / ₋₂₅		ASTIER	69	HBC	$\bar{p} p$
60	45	CRENNELL	67	HBC	$6 \pi^- p \rightarrow \Lambda K 2\pi$

¹Systematic errors not estimated.NODE=M028W1
NODE=M028W1

NODE=M028W1;LINKAGE=AB

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
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The data in this block is included in the average printed for a previous datablock.

260 ⁺⁹⁰/₋₇₀ ± 80	7k	ASNER	00B	CLEO	$\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
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NODE=M028WT
NODE=M028WT **$K_1(1270)$ DECAY MODES**

NODE=M028215;NODE=M028

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 $K\rho$	(38 ± 13) %	2.2
Γ_2 $K_0^*(1430)\pi$	(28 ± 4) %	
Γ_3 $K^*(892)\pi$	(21 ± 10) %	2.2
Γ_4 $K\omega$	(11.0 ± 2.0) %	
Γ_5 $K f_0(1370)$	(3.0 ± 2.0) %	
Γ_6 γK^0	seen	

DESIG=2
DESIG=7
DESIG=1
DESIG=5
DESIG=8
DESIG=9;OUR EST;→ UNCHECKED ← **$K_1(1270)$ PARTIAL WIDTHS**

NODE=M028220

 $\Gamma(K\rho)$ **Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

57 ± 5	MAZZUCATO	79	HBC	+	4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$
75 ± 6	CARNEGIE	77B	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W5
NODE=M028W5 **$\Gamma(K_0^*(1430)\pi)$** **Γ_2**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

26 ± 6	CARNEGIE	77B	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
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NODE=M028W7
NODE=M028W7 **$\Gamma(K^*(892)\pi)$** **Γ_3**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

14 ± 11	MAZZUCATO	79	HBC	+	4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$
2 ± 2	CARNEGIE	77B	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W4
NODE=M028W4 **$\Gamma(K\omega)$** **Γ_4**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

4 ± 4	MAZZUCATO	79	HBC	+	4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$
24 ± 3	CARNEGIE	77B	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$

NODE=M028W6
NODE=M028W6 **$\Gamma(K f_0(1370))$** **Γ_5**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

22 ± 5	CARNEGIE	77B	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
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NODE=M028W8
NODE=M028W8

$\Gamma(\gamma K^0)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
73.2±6.1±28.3	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$

NODE=M028W9
 NODE=M028W9

 $K_1(1270)$ BRANCHING RATIOS

NODE=M028225

 $\Gamma(K\rho)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.38 ±0.13 OUR FIT Error includes scale factor of 2.2.

0.42 ±0.06 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.584±0.043 ² GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$
 dominant RODEBACK 81 HBC $4 \pi^- p \rightarrow \Lambda K 2\pi$

NODE=M028R2
 NODE=M028R2

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.28 ±0.04 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0201±0.0064 ² GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R4
 NODE=M028R4

 $\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.21 ±0.10 OUR FIT Error includes scale factor of 2.2.

0.16 ±0.05 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.171±0.023 ² GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R1
 NODE=M028R1

 $\Gamma(K^*(892)\pi)/\Gamma(K\rho)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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0.56±0.29 OUR FIT Error includes scale factor of 2.2.

0.99±0.15±0.18 ABLIKIM 21U BES3 $D_s^+ \rightarrow \bar{K}_1(1270)^0 K^+$

NODE=M028R00
 NODE=M028R00

 $\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.11 ±0.02 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.225±0.052 ² GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028R3
 NODE=M028R3

 $\Gamma(K\omega)/\Gamma(K\rho)$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.30 95 RODEBACK 81 HBC $4 \pi^- p \rightarrow \Lambda K 2\pi$

NODE=M028R6
 NODE=M028R6

 $\Gamma(K f_0(1370))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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0.03±0.02 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M028R5
 NODE=M028R5

 D -wave/ S -wave RATIO FOR $K_1(1270) \rightarrow K^*(892)\pi$

NODE=M028R9
 NODE=M028R9

VALUE	DOCUMENT ID	TECN	COMMENT
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1.0±0.7 ¹ DAUM 81C CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data.

² Assuming that decays are saturated by the $K\rho$, $K_0^*(1430)\pi$, $K^*(892)\pi$, $K\omega$ decay modes and neglecting interference between them. The values $B(\omega \rightarrow \pi^+ \pi^-) = (1.53^{+0.11}_{-0.13})\%$ and $B(K_0^*(1430) \rightarrow K\pi) = (93 \pm 10)\%$ are used. Systematic uncertainties not estimated.

NODE=M028R;LINKAGE=F
 NODE=M028R1;LINKAGE=GU

$K_1(1270)$ REFERENCES

ABLIKIM	21U	PR D104 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	18A1	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)
GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
GENG	07	PR D75 014017	L.S. Geng <i>et al.</i>	
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
RODEBACK	81	ZPHY C9 9	S. Rodeback <i>et al.</i>	(CERN, CDEF, MADR+)
MAZZUCATO	79	NP B156 532	M. Mazzucato <i>et al.</i>	(CERN, ZEEM, NIJM+)
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)
GAVILLET	78	PL 76B 517	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJM+)
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)
CARNEGIE	77B	PL 68B 287	R.K. Carnegie <i>et al.</i>	(SLAC)
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP
OTTER	76	NP B106 77	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP
CRENNELL	72	PR D6 1220	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
ASTIER	69	NP B10 65	A. Astier <i>et al.</i>	(CDEF, CERN, IPNP, LIVP) JJP
CRENNELL	67	PRL 19 44	D.J. Crennell <i>et al.</i>	(BNL) I

NODE=M028

REFID=61155
 REFID=59187
 REFID=53668
 REFID=51623
 REFID=51037
 REFID=48822
 REFID=47766
 REFID=20573
 REFID=22548
 REFID=22550
 REFID=20867
 REFID=22542
 REFID=22538
 REFID=22535
 REFID=22536
 REFID=22532
 REFID=22533
 REFID=22419
 REFID=22505
 REFID=22506
 REFID=22482
 REFID=22473

NODE=M064

 $K_1(1400)$

$$I(J^P) = \frac{1}{2}(1^+)$$

 $K_1(1400)$ MASS

NODE=M064M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1403 ± 7 OUR AVERAGE					
1463 ± 64 ± 68	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
1373 ± 14 ± 18		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1392 ± 18		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
1410 ± 25		DAUM	81C	CNTR	- $63 K^- p \rightarrow K^- 2\pi p$
1415 ± 15		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1404 ± 10		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1418 ± 8	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 1350		⁴ TORNQVIST	82B	RVUE	
~ 1400		VERGEEST	79	HBC	- $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 1400		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
1420		DAVIS	72	HBC	+ $12 K^+ p$
1368 ± 18		FIRESTONE	72B	DBC	+ $12 K^+ d$

NODE=M064M

NODE=M064M

¹ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.³ Systematic errors not estimated.⁴ From a unitarized quark-model calculation.

NODE=M064M;LINKAGE=P
 NODE=M064M;LINKAGE=E
 NODE=M064M;LINKAGE=AB
 NODE=M064M;LINKAGE=T

 $K_1(1400)$ WIDTH

NODE=M064W

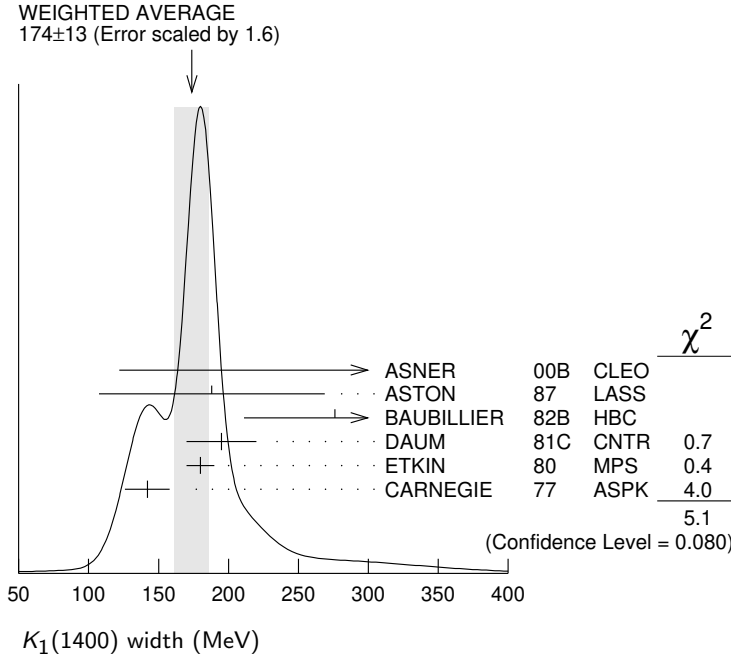
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
174 ± 13 OUR AVERAGE					
Error includes scale factor of 1.6. See the ideogram below.					
$300^{+370}_{-110} \pm 140$	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
188 ± 54 ± 60		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
276 ± 65		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
195 ± 25		DAUM	81C	CNTR	- $63 K^- p \rightarrow K^- 2\pi p$
180 ± 10		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
142 ± 16		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
152 ± 16	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 200		VERGEEST	79	HBC	- $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 160		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
80		DAVIS	72	HBC	+ $12 K^+ p$
241 ± 30		FIRESTONE	72B	DBC	+ $12 K^+ d$

NODE=M064W

NODE=M064W

- ¹ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.
- ² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.
- ³ Systematic errors not estimated.

NODE=M064W;LINKAGE=P
 NODE=M064W;LINKAGE=E
 NODE=M064W;LINKAGE=AB



$K_1(1400)$ DECAY MODES

NODE=M064215;NODE=M064

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	(94 \pm 6) %
Γ_2 $K\rho$	(3.0 \pm 3.0) %
Γ_3 $K f_0(1370)$	(2.0 \pm 2.0) %
Γ_4 $K\omega$	(1.0 \pm 1.0) %
Γ_5 $K_0^*(1430)\pi$	not seen
Γ_6 γK^0	seen
Γ_7 $K\phi$	seen

DESIG=1
 DESIG=2
 DESIG=8
 DESIG=5
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=10

$K_1(1400)$ PARTIAL WIDTHS

NODE=M064220

$\Gamma(K^*(892)\pi)$					Γ_1
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
117\pm10	CARNEGIE	77	ASPK	\pm 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$	
$\Gamma(K\rho)$					Γ_2
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
2\pm1	CARNEGIE	77	ASPK	\pm 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$	
$\Gamma(K\omega)$					Γ_4
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
23\pm12	CARNEGIE	77	ASPK	\pm 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$	
$\Gamma(\gamma K^0)$					Γ_6
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
280.8\pm23.2\pm40.4	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$		

NODE=M064W1
 NODE=M064W1
 NODE=M064W2
 NODE=M064W2
 NODE=M064W5
 NODE=M064W5
 NODE=M064W6
 NODE=M064W6

$K_1(1400)$ BRANCHING RATIOS

NODE=M064225

$\Gamma(K^*(892)\pi)/\Gamma_{total}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.94\pm0.06	¹ DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R1
 NODE=M064R1

¹ Average from low and high t data.

NODE=M064R1;LINKAGE=F

$\Gamma(K\rho)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.03 ± 0.03	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_2/Γ NODE=M064R2
NODE=M064R2

NODE=M064R2;LINKAGE=F

 $\Gamma(K f_0(1370))/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.02 ± 0.02	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_3/Γ NODE=M064R5
NODE=M064R5

NODE=M064R5;LINKAGE=F

 $\Gamma(K\omega)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.01 ± 0.01	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_4/Γ NODE=M064R3
NODE=M064R3

NODE=M064R3;LINKAGE=F

 $\Gamma(K\phi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi \phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 9.2 σ . Γ_7/Γ NODE=M064R00
NODE=M064R00

NODE=M064R00;LINKAGE=A

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_5/Γ NODE=M064R4
NODE=M064R4

NODE=M064R4;LINKAGE=F

D-wave/S-wave RATIO FOR $K_1(1400) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
0.04 ± 0.01	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data.NODE=M064R9
NODE=M064R9

NODE=M064R9;LINKAGE=F

 $K_1(1400)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)	REFID=48822
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47766
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)	REFID=20573
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)	REFID=22542
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)	REFID=22535
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22532
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)	REFID=22505
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)	REFID=22506

NODE=M064

$K^*(1410)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M094

 $K^*(1410)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M094PP

NODE=M094PP

NODE=M094PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1368 ± 38) - i (106⁺⁴⁸₋₅₉) OUR ESTIMATE			
(1368 ± 38) - i (106 ⁺⁴⁸ ₋₅₉)	¹ PELAEZ	17 RVUE	$\pi K \rightarrow \pi K$

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

→ UNCHECKED ←
OCCUR=2

NODE=M094PP;LINKAGE=B

 $K^*(1410)$ MASS

NODE=M094M

NODE=M094M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1414 ± 15 OUR AVERAGE					Error includes scale factor of 1.3.
1380 ± 21 ± 19		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1420 ± 7 ± 10		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1437 ± 8 ± 16	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
1426 ± 8 ± 24	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
1276 ⁺⁷² ₋₇₇		^{3,4} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
1367 ± 54		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1474 ± 25		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
1500 ± 30		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

OCCUR=2

NODE=M094M;LINKAGE=A

NODE=M094M;LINKAGE=C

NODE=M094M;LINKAGE=BI

NODE=M094M;LINKAGE=NS

- ¹ Using a parametrization for the $K\pi$ S -wave similar to ASTON 88 with fixed resonance width.
² Using a $K\pi$ S -wave parametrization with resonant and non-resonant contributions.
³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
⁴ Systematic uncertainties not estimated.

 $K^*(1410)$ WIDTH

NODE=M094W

NODE=M094W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
232 ± 21 OUR AVERAGE					Error includes scale factor of 1.1.
176 ± 52 ± 22		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
240 ± 18 ± 12		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
210 ± 20 ± 60	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
270 ± 20 ± 40	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
198 ⁺⁶¹ ₋₈₇		^{2,3} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
114 ± 101		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
275 ± 65		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
500 ± 100		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

OCCUR=2

NODE=M094W;LINKAGE=A

NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

- ¹ Using a $K\pi$ S -wave parametrization with resonant and non-resonant contributions.
² From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.
³ Systematic uncertainties not estimated.

 $K^*(1410)$ DECAY MODES

NODE=M094215;NODE=M094

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K^*(892)\pi$	> 40 %	95%
Γ_2 $K\pi$	(6.6 ± 1.3) %	
Γ_3 $K\rho$	< 7 %	95%
Γ_4 γK^0	< 2.3 × 10 ⁻⁴	90%
Γ_5 $K\phi$	seen	

DESIG=2

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

DESIG=5

$K^*(1410)$ PARTIAL WIDTHS $\Gamma(\gamma K^0)$ Γ_4

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$

NODE=M094217

NODE=M094W1
NODE=M094W1 **$K^*(1410)$ BRANCHING RATIOS** $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.17	95	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094220

NODE=M094R1
NODE=M094R1 $\Gamma(K\pi)/\Gamma(K^*(892)\pi)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.16	95	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R2
NODE=M094R2 $\Gamma(K\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
$0.066 \pm 0.010 \pm 0.008$	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M094R3
NODE=M094R3 $\Gamma(K\phi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M094R00
NODE=M094R00¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.7 σ .

NODE=M094R00;LINKAGE=A

 $K^*(1410)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
BOITO	09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)

NODE=M094

REFID=61150
REFID=57836
REFID=57273
REFID=52728
REFID=51929
REFID=48822
REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22551
REFID=22545
REFID=22443 $K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

NODE=M019

 $K_0^*(1430)$ T-MATRIX POLE \sqrt{s} Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M019PP

NODE=M019PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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(1431 \pm 6) - i (110 \pm 19) OUR ESTIMATE(1431 \pm 6) - i (110 \pm 19) ¹ PELAEZ 17 RVUE $\pi K \rightarrow \pi K$

NODE=M019PP

→ UNCHECKED ←

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M019PP;LINKAGE=A

 $K_0^*(1430)$ MASS

NODE=M019M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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1425 \pm 50 OUR ESTIMATE

• • • We do not use the following data for averages, fits, limits, etc. • • •

1493 \pm 4 \pm 7	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$
1449 \pm 17 \pm 2	² LEES	21A BABR	$\eta_c(1S) \rightarrow \eta' K^+ K^-$
1438 \pm 8 \pm 4 5.4k	³ LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$
1427 \pm 4 \pm 13	⁴ BUGG	10 RVUE	S-matrix pole
1466.6 \pm 0.7 \pm 3.4 141k	⁵ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1412	⁶ LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$
1461.0 \pm 4.0 \pm 2.1 54k	⁷ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
1406 \pm 29	⁸ BUGG	06 RVUE	
1435 \pm 6	⁹ ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$

NODE=M019M

→ UNCHECKED ←

1455 ±20 ±15	ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow$ $\gamma\pi^+\pi^-K^+K^-$
1456 ± 8	10 ZHENG	04	RVUE	$K^-p \rightarrow K^-\pi^+n$
~ 1419	11 BUGG	03	RVUE	11 $K^-p \rightarrow K^-\pi^+n$
~ 1440	12 LI	03	RVUE	11 $K^-p \rightarrow K^-\pi^+n$
1459 ± 9	13 AITALA	02	E791	$D^+ \rightarrow K^-\pi^+\pi^+$
~ 1440	14 JAMIN	00	RVUE	$Kp \rightarrow Kp$
1436 ± 8	15 BARBERIS	98E	OMEG	450 $pp \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ±25	11 ANISOVICH	97C	RVUE	11 $K^-p \rightarrow K^-\pi^+n$
~ 1450	16 TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$
1412 ± 6	17 ASTON	88	LASS	11 $K^-p \rightarrow K^-\pi^+n$
~ 1430	BAUBILLIER	84B	HBC	8.25 $K^-p \rightarrow \bar{K}^0\pi^-p$
~ 1425	18 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow K^\pm\pi^\pm(n, \Delta)$
~ 1450.0	MARTIN	78	SPEC	10 $K^\pm p \rightarrow K_S^0\pi p$

¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c.$

² Using a $K\pi-K\eta'$ coupled channel Breit-Wigner function.

³ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed width $\Gamma(K_0^*(1430)) = 210$ MeV.

⁴ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.

⁵ From the isobar model with a complex pole for the κ .

⁶ From a non-parametric analysis.

⁷ A Breit-Wigner mass and width.

⁸ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.

⁹ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$.

¹⁰ Using ASTON 88 and assuming $K_0^*(700)$.

¹¹ T-matrix pole. Reanalysis of ASTON 88 data.

¹² Breit-Wigner fit. Using ASTON 88.

¹³ Assuming a low-mass scalar $K\pi$ resonance, $\kappa(700)$.

¹⁴ T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹⁵ J^P not determined, could be $K_2^*(1430)$.

¹⁶ T-matrix pole.

¹⁷ Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° .

¹⁸ Mass defined by pole position. From elastic $K\pi$ partial-wave analysis.

NODE=M019M;LINKAGE=F
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NODE=M019M;LINKAGE=BG

NODE=M019M;LINKAGE=BO
NODE=M019M;LINKAGE=LI
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NODE=M019M;LINKAGE=BU

NODE=M019M;LINKAGE=ZU
NODE=M019M;LINKAGE=ZH
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NODE=M019M;LINKAGE=E
NODE=M019M;LINKAGE=A0
NODE=M019M;LINKAGE=JM
NODE=M019M;LINKAGE=JP
NODE=M019M;LINKAGE=TT
NODE=M019M;LINKAGE=D

NODE=M019M;LINKAGE=A

$K_0^*(1430)$ WIDTH

NODE=M019W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
270 ±80	OUR ESTIMATE			

NODE=M019W

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

215 ± 7 ± 4	1	AAIJ	23AH	LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$
210 ±20 ±12	5.4k	2	LEES	14E	BABR $\eta_c(1S) \rightarrow K^+K^-\eta/\pi^0$
270 ±10 ±40		3	BUGG	10	RVUE S-matrix pole
174.2± 1.9± 3.2	141k	4	BONVICINI	08A	CLEO $D^+ \rightarrow K^-\pi^+\pi^+$
~ 500		5	LINK	07	FOCS $D^+ \rightarrow K^-\pi^+\pi^+$
177.0± 8.0± 3.4	54k	6	LINK	07B	FOCS $D^+ \rightarrow K^-\pi^+\pi^+$
350 ±40		7	BUGG	06	RVUE
288 ±22		8	ZHOU	06	RVUE $Kp \rightarrow K^-\pi^+n$
270 ±45 ⁺³⁰ -35		ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$
217 ±31		9	ZHENG	04	RVUE $K^-p \rightarrow K^-\pi^+n$
~ 316		10	BUGG	03	RVUE 11 $K^-p \rightarrow K^-\pi^+n$
~ 350		11	LI	03	RVUE 11 $K^-p \rightarrow K^-\pi^+n$
175 ±17	15k	12	AITALA	02	E791 $D^+ \rightarrow K^-\pi^+\pi^+$
~ 300		13	JAMIN	00	RVUE $Kp \rightarrow Kp$
196 ±45		14	BARBERIS	98E	OMEG 450 $pp \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
330 ±50		10	ANISOVICH	97C	RVUE 11 $K^-p \rightarrow K^-\pi^+n$
~ 320		15	TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$
294 ±23		ASTON	88	LASS	11 $K^-p \rightarrow K^-\pi^+n$
~ 200		BAUBILLIER	84B	HBC	8.25 $K^-p \rightarrow \bar{K}^0\pi^-p$
200 to 300		16	ESTABROOKS	78	ASPK 13 $K^\pm p \rightarrow K^\pm\pi^\pm(n, \Delta)$

- ¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$
- ² Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed mass $M(K_0^*(1430)) = 1435$ MeV.
- ³ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.
- ⁴ From the isobar model with a complex pole for the κ .
- ⁵ From a non-parametric analysis.
- ⁶ A Breit-Wigner mass and width.
- ⁷ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.
- ⁸ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$.
- ⁹ Using ASTON 88 and assuming $K_0^*(700)$.
- ¹⁰ T-matrix pole. Reanalysis of ASTON 88 data.
- ¹¹ Breit-Wigner fit. Using ASTON 88.
- ¹² Assuming a low-mass scalar $K\pi$ resonance, $\kappa(700)$.
- ¹³ T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.
- ¹⁴ J^P not determined, could be $K_2^*(1430)$.
- ¹⁵ T-matrix pole.
- ¹⁶ From elastic $K\pi$ partial-wave analysis.

NODE=M019W;LINKAGE=A
 NODE=M019W;LINKAGE=LE
 NODE=M019W;LINKAGE=BG
 NODE=M019W;LINKAGE=BO
 NODE=M019W;LINKAGE=LI
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 NODE=M019W;LINKAGE=BU
 NODE=M019W;LINKAGE=ZU
 NODE=M019W;LINKAGE=ZH
 NODE=M019W;LINKAGE=A1
 NODE=M019W;LINKAGE=E
 NODE=M019W;LINKAGE=A0
 NODE=M019W;LINKAGE=JM
 NODE=M019W;LINKAGE=JP
 NODE=M019W;LINKAGE=TT
 NODE=M019W;LINKAGE=C

$K_0^*(1430)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(93 \pm 10) %
Γ_2 $K\eta$	(8.6 $^{+2.7}_{-3.4}$) %
Γ_3 $K\eta'(958)$	seen

NODE=M019215;NODE=M019

DESIG=1

DESIG=2

DESIG=3

$K_0^*(1430)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
	0.93\pm0.04\pm0.09	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M019220

NODE=M019R1
 NODE=M019R1

$\Gamma(K\eta)/\Gamma(K\pi)$	VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
	9.2\pm2.5$^{+1.0}_{-2.5}$	5.4k	¹ LEES	14E	BABR $\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$	

NODE=M019R01
 NODE=M019R01

- ¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a Dalitz analysis in the presence of several interfering scalar-meson resonances.

NODE=M019R01;LINKAGE=LE

$\Gamma(K\eta'(958))/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
	seen	ABLIKIM	14J	BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M019R00
 NODE=M019R00

$\Gamma(K\eta'(958))/\Gamma(K\pi)$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
	0.397\pm0.064\pm0.054	¹ LEES	21A	BABR $\eta_c(1S) \rightarrow \eta' K^+ K^-$	

NODE=M019R02
 NODE=M019R02

- ¹ Using $K\pi$ data from LEES 14E.

NODE=M019R02;LINKAGE=A

$K_0^*(1430)$ REFERENCES

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61442
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55901
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)	REFID=53213
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=53056
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=52426
LINK	07	PL B648 156	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=51702
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=51875
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=51051
Also		PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=51458
BUGG	06	PL B632 471	D.V. Bugg	(LOQM)	REFID=50996
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng		REFID=51198

NODE=M019

ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
LI	03	PR D67 034025	L. Li, B. Zou, G. Li	
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
JAMIN	00	NP B587 331	M. Jamin <i>et al.</i>	
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev	
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)

REFID=50958
 REFID=50165
 REFID=49586
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 REFID=47983
 REFID=46348
 REFID=45815
 REFID=44507
 REFID=40262
 REFID=22459
 REFID=22443
 REFID=22446

NODE=M022

$K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

We consider that phase-shift analyses provide more reliable determinations of the mass and width.

NODE=M022

$K_2^*(1430)$ T-MATRIX POLE \sqrt{s}

NODE=M022PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M022PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1424 ± 4) - i (66 ± 2) OUR ESTIMATE			
(1424 ± 4) - i (66 ± 2)	¹ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$

NODE=M022PP

→ UNCHECKED ←

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M022PP;LINKAGE=A

$K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1427.3 ± 1.5 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
1432.7 ± 0.7 ^{+2.2} _{-2.3}	183k	ABLIKIM	19AQ	BES	± $J/\psi \rightarrow K^+ K^- \pi^0$
1420 ± 4	1587	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1436 ± 5.5	400	^{1,2} CLELAND	82	SPEC	+ 30 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{1,2} CLELAND	82	SPEC	+ 50 $K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{1,2} CLELAND	82	SPEC	- 50 $K^+ p \rightarrow K_S^0 \pi^- p$
1423 ± 5	935	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1428.0 ± 4.6		³ MARTIN	78	SPEC	+ 10 $K^\pm p \rightarrow K_S^0 \pi p$
1423.8 ± 4.6		³ MARTIN	78	SPEC	- 10 $K^\pm p \rightarrow K_S^0 \pi p$
1420.0 ± 3.1	1400	AGUILAR-...	71B	HBC	- 3.9, 4.6 $K^- p$
1425 ± 8.0	225	^{1,2} BARNHAM	71C	HBC	+ $K^+ p \rightarrow K^0 \pi^+ p$
1416 ± 10	220	CRENNELL	69D	DBC	- 3.9 $K^- N \rightarrow \bar{K}^0 \pi^- N$
1414 ± 13.0	60	¹ LIND	69	HBC	+ 9 $K^+ p \rightarrow K^0 \pi^+ p$
1427 ± 12	63	¹ SCHWEING...	68	HBC	- 5.5 $K^- p \rightarrow \bar{K} \pi N$
1423 ± 11.0	39	¹ BASSANO	67	HBC	- 4.6-5.0 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M022M1
 NODE=M022M1

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1428 ± 2	4300	⁴ ABLIKIM	22L	BES3	2.0-3.08 $e^+ e^- \rightarrow K^+ K^- \pi^0$
1423.4 ± 2 ± 3	24809 ± 820	⁵ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

¹ Errors enlarged by us to Γ/\sqrt{N} ; see the note with the $K^*(892)$ mass.

² Number of events in peak re-evaluated by us.

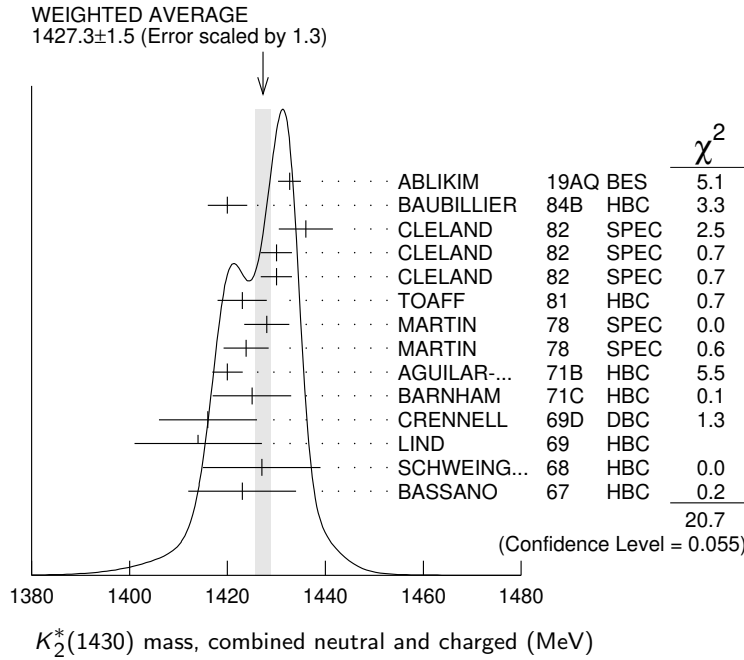
³ Systematic error added by us.

⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

⁵ From a partial wave amplitude analysis.

NODE=M022M;LINKAGE=D
 NODE=M022M;LINKAGE=W
 NODE=M022M;LINKAGE=B
 NODE=M022M1;LINKAGE=A

NODE=M022M;LINKAGE=F



NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1432.4± 1.3 OUR AVERAGE				
1431.2± 1.8± 0.7		¹ ASTON 88 LASS		11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 4 ± 6		¹ ASTON 87 LASS		11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1433 ± 6 ± 10		¹ ASTON 84B LASS		11 $K^- p \rightarrow \bar{K}^0 2\pi n$
1471 ± 12		¹ BAUBILLIER 82B HBC		8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
1428 ± 3		¹ ASTON 81C LASS		11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 2		¹ ESTABROOKS 78 ASPK		13 $K^\pm p \rightarrow pK\pi$
1440 ± 10		¹ BOWLER 77 DBC		5.5 $K^+ d \rightarrow K\pi pp$
1428.5± 3.9	1786± 127	² AUBERT 07AK BABR		10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
1420 ± 7	300	HENDRICK 76 DBC		8.25 $K^+ N \rightarrow K^+ \pi N$
1421.6± 4.2	800	MCCUBBIN 75 HBC		3.6 $K^- p \rightarrow K^- \pi^+ n$
1420.1± 4.3		³ LINGLIN 73 HBC		2-13 $K^+ p \rightarrow K^+ \pi^- X$
1419.1± 3.7	1800	AGUILAR-... 71B HBC		3.9,4.6 $K^- p$
1416 ± 6	600	CORDS 71 DBC		9 $K^+ n \rightarrow K^+ \pi^- p$
1421.1± 2.6	2200	DAVIS 69 HBC		12 $K^+ p \rightarrow K^+ \pi^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

- ¹ From phase shift or partial-wave analysis.
- ² Systematic errors not estimated.
- ³ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022M4
NODE=M022M4

NODE=M022M;LINKAGE=P
NODE=M022M4;LINKAGE=NS
NODE=M022M;LINKAGE=C

$K_2^*(1430)$ WIDTH

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
100.0± 2.2 OUR FIT					Error includes scale factor of 1.1.
100.0± 2.2 OUR AVERAGE					Error includes scale factor of 1.1.
102.5± 1.6 ^{+3.1} _{-2.8}	183k	ABLIKIM 19AQ BES		±	$J/\psi \rightarrow K^+ K^- \pi^0$
109 ± 22	400	^{1,2} CLELAND 82 SPEC		+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
124 ± 12.8	1500	^{1,2} CLELAND 82 SPEC		+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
113 ± 12.8	1200	^{1,2} CLELAND 82 SPEC		-	50 $K^+ p \rightarrow K_S^0 \pi^- p$
85 ± 16	935	TOAFF 81 HBC		-	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
96.5 ± 3.8		MARTIN 78 SPEC		+	10 $K^\pm p \rightarrow K_S^0 \pi p$
97.7 ± 4.0		MARTIN 78 SPEC		-	10 $K^\pm p \rightarrow K_S^0 \pi p$
94.7 ^{+15.1} _{-12.5}	1400	AGUILAR-... 71B HBC		-	3.9,4.6 $K^- p$
107 ± 4	4300	³ ABLIKIM 22L BES3			2.0-3.08 $e^+ e^- \rightarrow K^+ K^- \pi^0$
98 ± 4 ± 4	25k	⁴ BIRD 89 LASS		-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M022210

NODE=M022W1
NODE=M022W1

OCCUR=2

OCCUR=3

OCCUR=2

- ¹ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ² Number of events in peak re-evaluated by us.
- ³ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.
- ⁴ From a partial wave amplitude analysis.

NODE=M022W;LINKAGE=D
 NODE=M022W;LINKAGE=W
 NODE=M022W1;LINKAGE=A

NODE=M022W;LINKAGE=F

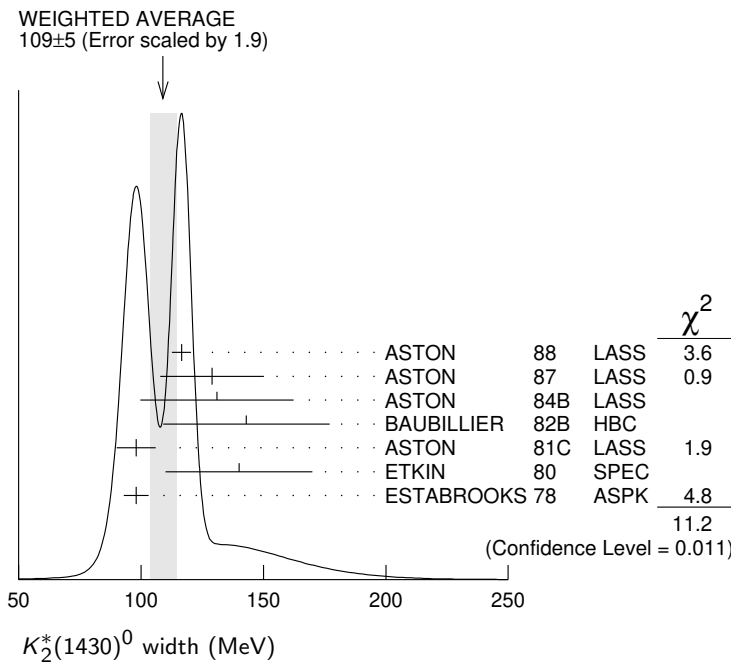
NODE=M022W4
 NODE=M022W4

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
109 ± 5 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
116.5 ± 3.6 ± 1.7		¹ ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
129 ± 15 ± 15		¹ ASTON 87	LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
131 ± 24 ± 20		¹ ASTON 84B	LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
143 ± 34		¹ BAUBILLIER 82B	HBC	8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
98 ± 8		¹ ASTON 81C	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
140 ± 30		¹ ETKIN 80	SPEC	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
98 ± 5		¹ ESTABROOKS 78	ASPK	13 $K^\pm p \rightarrow pK\pi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
113.7 ± 9.2	1786 ± 127	² AUBERT 07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
125 ± 29	300	³ HENDRICK 76	DBC	8.25 $K^+ N \rightarrow K^+ \pi N$
116 ± 18	800	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
61 ± 14		⁴ LINGLIN 73	HBC	2-13 $K^+ p \rightarrow K^+ \pi^- X$
116.6 ^{+10.3} _{-15.5}	1800	AGUILAR-...	71B	HBC 3.9,4.6 $K^- p$
144 ± 24.0	600	³ CORDS 71	DBC	9 $K^+ n \rightarrow K^+ \pi^- p$
101 ± 10	2200	DAVIS 69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$

NODE=M022W;LINKAGE=P
 NODE=M022W4;LINKAGE=NS
 NODE=M022W4;LINKAGE=D
 NODE=M022W;LINKAGE=C

- ¹ From phase shift or partial-wave analysis.
- ² Systematic errors not estimated.
- ³ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ⁴ From pole extrapolation, using world $K^+ p$ data summary tape.



$K_2^*(1430)$ DECAY MODES

NODE=M022215;NODE=M022

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $K\pi$	(49.9 ± 1.2) %	
Γ_2 $K^*(892)\pi$	(24.7 ± 1.5) %	
Γ_3 $K^*(892)\pi\pi$	(13.4 ± 2.2) %	
Γ_4 $K\rho$	(8.7 ± 0.8) %	S=1.2

DESIG=1
 DESIG=2
 DESIG=6
 DESIG=3

Γ_5	$K\omega$	$(2.9 \pm 0.8) \%$		DESIG=4
Γ_6	$K^+\gamma$	$(2.4 \pm 0.5) \times 10^{-3}$	S=1.1	DESIG=8
Γ_7	$K\eta$	$(1.5^{+3.4}_{-1.0}) \times 10^{-3}$	S=1.3	DESIG=5
Γ_8	$K\omega\pi$	$< 7.2 \times 10^{-4}$	CL=95%	DESIG=7
Γ_9	$K^0\gamma$	$< 9 \times 10^{-4}$	CL=90%	DESIG=10;OUR EVAL;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 10 branching ratios uses 32 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 21.1$ for 25 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-9						
x_3	-40	-73					
x_4	-8	36	-52				
x_5	-11	-3	-26	-7			
x_6	-1	-1	-1	-1	0		
x_7	-4	-7	-5	-5	-2	0	
Γ	0	0	0	0	0	-11	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $K\pi$	49.9 ± 1.6	
Γ_2 $K^*(892)\pi$	24.7 ± 1.6	
Γ_3 $K^*(892)\pi\pi$	13.5 ± 2.3	
Γ_4 $K\rho$	8.7 ± 0.8	1.2
Γ_5 $K\omega$	2.9 ± 0.8	
Γ_6 $K^+\gamma$	0.24 ± 0.05	1.1
Γ_7 $K\eta$	$0.15^{+0.34}_{-0.10}$	1.3

$K_2^*(1430)$ PARTIAL WIDTHS

$\Gamma(K^+\gamma)$

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
240 ± 50 OUR FIT				Error includes scale factor of 1.1.
240 ± 45	CIHANGIR	82	SPEC +	$200 K^+ Z \rightarrow Z K^+ \pi^0,$ $Z K_S^0 \pi^+$

 Γ_6

NODE=M022220

NODE=M022W8
NODE=M022W8

$\Gamma(K^0\gamma)$

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 5.4	90	ALAVI-HARATI02B	KTEV		$K + A \rightarrow K^* + A$
●●● We do not use the following data for averages, fits, limits, etc. ●●●					
< 84	90	CARLSMITH	87	SPEC 0	$60-200 K_L^0 A \rightarrow$ $K_S^0 \pi^0 A$

 Γ_9 NODE=M022W9
NODE=M022W9

$K_2^*(1430)$ BRANCHING RATIOS

$\Gamma(K\pi) / \Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹ ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
0.49 ± 0.02	¹ ESTABROOKS	78	ASPK ±	$13 K^\pm p \rightarrow p K \pi$

¹ From phase shift analysis. Γ_1 / Γ

NODE=M022225

NODE=M022R1
NODE=M022R1

NODE=M022R;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

Γ_2/Γ_1

NODE=M022R4
NODE=M022R4

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.496±0.034 OUR FIT				
0.47 ±0.04 OUR AVERAGE				
0.44 ±0.09	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.62 ±0.19	LAUSCHER	75	HBC	0 10,16 $K^- p \rightarrow K^- \pi^+ n$
0.54 ±0.16	DEHM	74	DBC	0 4.6 $K^+ N$
0.47 ±0.08	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.47 ±0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.45 ±0.13	BADIER	65C	HBC	- 3 $K^- p$

$\Gamma(K\omega)/\Gamma(K\pi)$

Γ_5/Γ_1

NODE=M022R5
NODE=M022R5

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.059±0.017 OUR FIT				
0.070±0.035 OUR AVERAGE				
0.05 ±0.04	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.13 ±0.07	BASSOMPIE...	69	HBC	0 5 $K^+ p$

OCCUR=2

$\Gamma(K\rho)/\Gamma(K\pi)$

Γ_4/Γ_1

NODE=M022R6
NODE=M022R6

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.174±0.017 OUR FIT Error includes scale factor of 1.2.				
0.150^{+0.029}_{-0.017} OUR AVERAGE				
0.18 ±0.05	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.02 ^{+0.10} _{-0.02}	DEHM	74	DBC	0 4.6 $K^+ N$
0.16 ±0.05	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.14 ±0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.14 ±0.07	BADIER	65C	HBC	- 3 $K^- p$

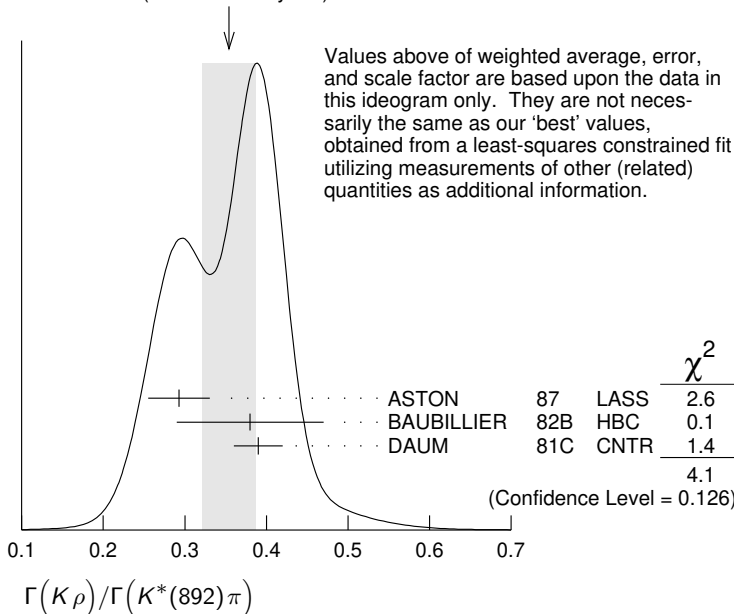
$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

Γ_4/Γ_2

NODE=M022R7
NODE=M022R7

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.350±0.031 OUR FIT Error includes scale factor of 1.4.				
0.354±0.033 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.				
0.293±0.032±0.020	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ±0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
0.39 ±0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

WEIGHTED AVERAGE
0.354±0.033 (Error scaled by 1.4)



$\Gamma(K\omega)/\Gamma(K^*(892)\pi)$

Γ_5/Γ_2

NODE=M022R8
NODE=M022R8

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.118±0.034 OUR FIT				
0.10 ±0.04	FIELD	67	HBC	- 3.8 $K^- p$

$\Gamma(K\eta)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ_2
-------	-------------	------	-----	---------	---------------------

0.006^{+0.014}_{-0.004} OUR FIT Error includes scale factor of 1.2.

0.07 ± 0.04 FIELD 67 HBC - 3.8 $K^- p$

NODE=M022R9
NODE=M022R9

 $\Gamma(K\eta)/\Gamma(K\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ_1
-------	-----	-------------	------	-----	---------	---------------------

0.0030^{+0.0070}_{-0.0020} OUR FIT Error includes scale factor of 1.3.

0 ± 0.0056 ¹ ASTON 88B LASS - 11 $K^- p \rightarrow K^- \eta p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04 95 AGUILAR-... 71B HBC 3.9,4.6 $K^- p$

<0.065 ² BASSOMPIE... 69 HBC 5.0 $K^+ p$

<0.02 BISHOP 69 HBC 3.5 $K^+ p$

¹ ASTON 88B quote < 0.0092 at CL=95%. We convert this to a central value and 1 sigma error in order to be able to use it in our constrained fit.

² Restated by us.

NODE=M022R10
NODE=M022R10

NODE=M022R;LINKAGE=PQ

NODE=M022R;LINKAGE=R

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_3/Γ
-------	-------------	------	-----	---------	-------------------

0.134 ± 0.022 OUR FIT

0.12 ± 0.04 ¹ GOLDBERG 76 HBC - 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

¹ Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R11
NODE=M022R11

NODE=M022R;LINKAGE=T

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_3/Γ_1
-------	-------------	------	-----	---------	---------------------

0.27 ± 0.05 OUR FIT

0.21 ± 0.08 ^{1,2} JONGEJANS 78 HBC - 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

¹ Restated by us.

² Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R12
NODE=M022R12

NODE=M022R12;LINKAGE=R
NODE=M022R12;LINKAGE=T

 $\Gamma(K\omega\pi)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ
---------------------------------	-----	------	-------------	------	---------	-------------------

<0.72 95 0 JONGEJANS 78 HBC 4 $K^- p \rightarrow p \bar{K}^0 4\pi$

NODE=M022R13
NODE=M022R13

 $K_2^*(1430)$ REFERENCES

ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61649
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)	REFID=48822
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
CARLSMITH	87	PR D36 3502	D. Carlsmith <i>et al.</i>	(EFI, SAFL)	REFID=40557
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22821
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJM+)	REFID=22445
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=22446
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
GOLDBERG	76	LNC 17 253	J. Goldberg	(HAIF)	REFID=22742
HENDRICK	76	NP B112 189	K. Hendrickx <i>et al.</i>	(MONS, SAFL, PARIS+)	REFID=22743
LAUSCHER	75	NP B86 189	P. Lauscher <i>et al.</i>	(ABCLV Collab.) JP	REFID=22582
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
DEHM	74	NP B75 47	G. Dehm <i>et al.</i>	(MPIM, BRUX, MONS, CERN)	REFID=22736
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
BARNHAM	71C	NP B28 171	K.W.J. Barnham <i>et al.</i>	(BIRM, GLAS)	REFID=22409
CORDS	71	PR D4 1974	D. Cords <i>et al.</i>	(PURD, UCD, IUPU)	REFID=22411
BASSOMPIE...	69	NP B13 189	G. Bassompierre <i>et al.</i>	(CERN, BRUX) JP	REFID=22710
BISHOP	69	NP B9 403	J.M. Bishop <i>et al.</i>	(WISC)	REFID=22485
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)	REFID=22400
LIND	69	NP B14 1	V.G. Lind <i>et al.</i>	(LRL) JP	REFID=22404
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
Also		Thesis	F.L. Schweingruber	(NWES, NWES)	REFID=22709
BASSANO	67	PRL 19 968	D. Bassano <i>et al.</i>	(BNL, SYRA)	REFID=22695
FIELD	67	PL 24B 638	J.H. Field <i>et al.</i>	(UCSD)	REFID=22701
BADIER	65C	PL 19 612	J. Badier <i>et al.</i>	(EPOL, SAFL, AMST)	REFID=22690

NODE=M022

K(1460)

$$I(J^P) = \frac{1}{2}(0^-)$$

Observed in $K\pi\pi$ partial-wave analysis.

NODE=M021

NODE=M021

NODE=M021M

NODE=M021M

NODE=M021M;LINKAGE=A

NODE=M021W

NODE=M021W

NODE=M021W;LINKAGE=A

NODE=M021215;NODE=M021

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

NODE=M021220

NODE=M021W1
NODE=M021W1NODE=M021W2
NODE=M021W2NODE=M021W3
NODE=M021W3NODE=M021R00
NODE=M021R00

NODE=M021R00;LINKAGE=A

NODE=M021

K(1460) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1482.40 ± 3.58 ± 15.22	894k	AAIJ	18AI	LHCB	$D^0 \rightarrow K^\mp 2\pi^\pm \pi^\mp$
~ 1460	63	DAUM	81C	CNTR	$K^- p \rightarrow K^- 2\pi p$
~ 1400	13	¹ BRANDENB...	76B	ASPK	$K^\pm p \rightarrow K^\pm 2\pi p$

¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.

K(1460) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
335.60 ± 6.20 ± 8.65	894k	AAIJ	18AI	LHCB	$D^0 \rightarrow K^\mp 2\pi^\pm \pi^\mp$
~ 260	63	DAUM	81C	CNTR	$K^- p \rightarrow K^- 2\pi p$
~ 250	15	¹ BRANDENB...	76B	ASPK	$K^\pm p \rightarrow K^\pm 2\pi p$

¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.

K(1460) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K\rho$	seen
Γ_3 $K_0^*(1430)\pi$	seen
Γ_4 $K\phi$	seen

K(1460) PARTIAL WIDTHS **$\Gamma(K^*(892)\pi)$ Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
~ 109	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

 $\Gamma(K\rho)$ Γ_2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
~ 34	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

 $\Gamma(K_0^*(1430)\pi)$ Γ_3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
~ 117	DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

 $\Gamma(K\phi)/\Gamma_{total}$ Γ_4/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi\phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 12 σ .**K(1460) REFERENCES**

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
AAIJ	18AI	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59187
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22767

$K_2(1580)$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K^- \pi^+ \pi^-$ system. Needs confirmation.

NODE=M039

NODE=M039

 $K_2(1580)$ MASS

NODE=M039M

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1580	OTTER	79	- 10,14,16 $K^- p$

NODE=M039M

 $K_2(1580)$ WIDTH

NODE=M039W

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 110	OTTER	79	- 10,14,16 $K^- p$

NODE=M039W

 $K_2(1580)$ DECAY MODES

NODE=M039215;NODE=M039

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K_2^*(1430)\pi$	possibly seen

DESIG=1

DESIG=2

 $K_2(1580)$ BRANCHING RATIOS

NODE=M039220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	OTTER	79	HBC	- 10,14,16 $K^- p$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$	

NODE=M039R1
NODE=M039R1

$\Gamma(K_2^*(1430)\pi)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
possibly seen	OTTER	79	HBC	- 10,14,16 $K^- p$	

NODE=M039R2
NODE=M039R2 **$K_2(1580)$ REFERENCES**

NODE=M039

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
OTTER	79	NP B147 I	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP

REFID=53668

REFID=22772

K(1630)

$$I(J^P) = \frac{1}{2}(?^?)$$

OMITTED FROM SUMMARY TABLE

Seen as a narrow peak, compatible with the experimental resolution, in the invariant mass of the $K_S^0 \pi^+ \pi^-$ system produced in $\pi^- p$ interactions at high momentum transfers.

NODE=M160

NODE=M160

K(1630) MASS

NODE=M160M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1629±7	~ 75	KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow (K_S^0 \pi^+ \pi^-)$ $X^+ \pi^- X^0$

NODE=M160M

K(1630) WIDTH

NODE=M160W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16⁺¹⁹₋₁₆	~ 75	¹ KARNAUKHOV98	BC	16.0 $\pi^- p \rightarrow (K_S^0 \pi^+ \pi^-)$ $X^+ \pi^- X^0$

NODE=M160W

¹ Compatible with an experimental resolution of 14 ± 1 MeV.

NODE=M160W;LINKAGE=A

K(1630) DECAY MODES

NODE=M160215;NODE=M160

Mode

 $\Gamma_1 \quad K_S^0 \pi^+ \pi^-$

DESIG=1

K(1630) REFERENCES

KARNAUKHOV 98 PAN 61 203 V.M. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

NODE=M160

REFID=46371

NODE=M099

K₁(1650)

$$I(J^P) = \frac{1}{2}(1^+)$$

This entry contains various peaks in strange meson systems ($K^+ \phi$, $K \pi \pi$) reported in partial-wave analysis in the 1600–1900 mass region.

NODE=M099

K₁(1650) MASS

NODE=M099M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1650±50		FRAME	86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1861±10 ⁺¹⁶ ₋₄₆	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1911±37 ⁺¹²⁴ ₋₄₈	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1793±59 ⁺¹⁵³ ₋₁₀₁	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
~ 1840		ARMSTRONG	83	OMEG -	18.5 $K^- p \rightarrow 3K p$
~ 1800		DAUM	81C	CNTR -	63 $K^- p \rightarrow K^- 2\pi p$

NODE=M099M

OCCUR=2

¹ One of two K_1 states reported by AAIJ 21E. From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 4.5σ .

NODE=M099M;LINKAGE=C

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

NODE=M099M;LINKAGE=A

³ Superseded by AAIJ 21E.

NODE=M099M;LINKAGE=B

K₁(1650) WIDTH

NODE=M099W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150± 50		FRAME	86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$

NODE=M099W

• • • We do not use the following data for averages, fits, limits, etc. • • •

$149 \pm 41^{+231}_{-23}$	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$276 \pm 50^{+319}_{-159}$	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$365 \pm 157^{+138}_{-215}$	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
~ 250		DAUM	81C	CNTR	$63 K^- p \rightarrow K^- 2\pi p$

OCCUR=2

¹One of two K_1 states reported by AAIJ 21E. From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 4.5σ .

NODE=M099W;LINKAGE=C

²From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

NODE=M099W;LINKAGE=A

³Superseded by AAIJ 21E.

NODE=M099W;LINKAGE=B

$K_1(1650)$ DECAY MODES

NODE=M099215;NODE=M099

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K \phi$

DESIG=1

DESIG=2

$K_1(1650)$ REFERENCES

NODE=M099

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

REFID=61150

REFID=57657

REFID=57636

REFID=20569

REFID=22801

REFID=22548

NODE=M095

$K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

$K^*(1680)$ MASS

NODE=M095M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1718±18 OUR AVERAGE					
$1722 \pm 20^{+33}_{-109}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$1677 \pm 10 \pm 32$		ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
$1735 \pm 10 \pm 20$		ASTON	87	LASS 0	$11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M095M

• • • We do not use the following data for averages, fits, limits, etc. • • •

1678 ± 64		BIRD	89	LASS -	$11 K^- p \rightarrow \bar{K}^0 \pi^- p$
1800 ± 70		ETKIN	80	MPS 0	$6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
~ 1650		ESTABROOKS	78	ASPK 0	$13 K^\pm p \rightarrow K^\pm \pi^\pm n$

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

NODE=M095M;LINKAGE=A

$K^*(1680)$ WIDTH

NODE=M095W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
320±110 OUR AVERAGE Error includes scale factor of 4.2.					
$354 \pm 75^{+140}_{-181}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$205 \pm 16 \pm 34$		ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
$423 \pm 18 \pm 30$		ASTON	87	LASS 0	$11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M095W

• • • We do not use the following data for averages, fits, limits, etc. • • •

454 ± 270		BIRD	89	LASS -	$11 K^- p \rightarrow \bar{K}^0 \pi^- p$
170 ± 30		ETKIN	80	MPS 0	$6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
250 to 300		ESTABROOKS	78	ASPK 0	$13 K^\pm p \rightarrow K^\pm \pi^\pm n$

²From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

NODE=M095W;LINKAGE=A

K*(1680) DECAY MODES

NODE=M095215;NODE=M095

Mode	Fraction (Γ_i/Γ)	
Γ_1 $K\pi$	(38.7 \pm 2.5) %	DESIG=1
Γ_2 $K\rho$	(31.4 $^{+5.0}_{-2.1}$) %	DESIG=3
Γ_3 $K^*(892)\pi$	(29.9 $^{+2.2}_{-5.0}$) %	DESIG=2
Γ_4 $K\phi$	seen	DESIG=4
Γ_5 $K\eta$	(1.4 $^{+1.0}_{-0.8}$) %	DESIG=6

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 4 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 2.9$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-36	
x_3	-39	-72
	x_1	x_2

K*(1680) BRANCHING RATIOS

NODE=M095220

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.387\pm0.026 OUR FIT					NODE=M095R4
0.388\pm0.014\pm0.022	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	NODE=M095R4

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$					Γ_1/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
1.30$^{+0.23}_{-0.14}$ OUR FIT					NODE=M095R2
2.8 \pm1.1	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$	NODE=M095R2

$\Gamma(K\rho)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.81$^{+0.14}_{-0.09}$ OUR FIT					NODE=M095R3
1.2 \pm0.4	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$	NODE=M095R3

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$					Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
1.05$^{+0.27}_{-0.11}$ OUR FIT					NODE=M095R1
0.97\pm0.09$^{+0.30}_{-0.10}$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	NODE=M095R1

$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	³ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi \phi K^+$	NODE=M095R00
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	^{4,5} AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$	NODE=M095R00

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 4.7 σ .

⁴ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5 σ .

⁵ Superseded by AAIJ 21E.

NODE=M095R00;LINKAGE=B
 NODE=M095R00;LINKAGE=A
 NODE=M095R00;LINKAGE=C

$\Gamma(K\eta)/\Gamma(K\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_1
$0.037 \pm 0.007^{+0.024}_{-0.018}$	116k	⁶ CHEN	20A BELL	$D^0 \rightarrow K^- \pi^+ \eta$	NODE=M095R02 NODE=M095R02

⁶CHEN 20A quotes the ratio $\Gamma(K^*(1680)^- \rightarrow K^- \eta)/\Gamma(K^*(1680)^- \rightarrow K^- \pi^0) = 0.11 \pm 0.02^{+0.06}_{-0.04} \pm 0.04(\text{BPDG})$ where the last uncertainty comes from $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$. We divide it by 3 taking into account that $\Gamma(K^*(1680)^- \rightarrow K^- \pi^0)/\Gamma(K^*(1680)^- \rightarrow (K\pi)^-) = 1/3$.

NODE=M095R02;LINKAGE=A

 $\Gamma(K\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
$1.44 \pm 0.21^{+0.96}_{-0.73}$	116k	⁷ CHEN	20A BELL	$D^0 \rightarrow K^- \pi^+ \eta$	NODE=M095R01 NODE=M095R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

⁷From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 16σ . Not independent of the CHEN 20A measurement of $\Gamma(K^*(1680) \rightarrow K\eta)/\Gamma(K^*(1680) \rightarrow K\pi)$.

NODE=M095R01;LINKAGE=A

 $K^*(1680)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)	REFID=60333
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57657
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57636
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22689
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP	REFID=22443

NODE=M095

NODE=M023

 $K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04.

NODE=M023

 $K_2(1770)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	NODE=M023M
1773 ± 8 OUR AVERAGE						NODE=M023M
$1777 \pm 35^{+122}_{-77}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$	
1773 ± 8		² ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$	
1743 ± 15		TIKHOMIROV	03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
1810 ± 20		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$	
~ 1730		ARMSTRONG	83	OMEG -	$18.5 K^- p \rightarrow 3K p$	
~ 1780		³ DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$	
1710 ± 15	60	CHUNG	74	HBC -	$7.3 K^- p \rightarrow K^- \omega p$	
1767 ± 6		BLIEDEN	72	MMS -	$11-16 K^- p$	
1730 ± 20	306	⁴ FIRESTONE	72B	DBC +	$12 K^+ d$	
1765 ± 40		⁵ COLLEY	71	HBC +	$10 K^+ p \rightarrow K 2\pi N$	
1740		DENEGRI	71	DBC -	$12.6 K^- d \rightarrow K 2\pi d$	
1745 ± 20		AGUILAR-...	70C	HBC -	$4.6 K^- p$	
1780 ± 15		BARTSCH	70C	HBC -	$10.1 K^- p$	
1760 ± 15		LUDLAM	70	HBC -	$12.6 K^- p$	

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0σ .

²From a partial wave analysis of the $K^- \omega$ system.

³From a partial wave analysis of the $K^- 2\pi$ system.

⁴Produced in conjunction with excited deuteron.

⁵Systematic errors added correspond to spread of different fits.

NODE=M023M;LINKAGE=C

NODE=M023M;LINKAGE=A

NODE=M023M;LINKAGE=B

NODE=M023M;LINKAGE=P

NODE=M023M;LINKAGE=X

 $K_2(1770)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	NODE=M023W
186 ± 14 OUR AVERAGE						NODE=M023W
$217 \pm 116^{+221}_{-154}$	4289	⁶ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$	
186 ± 14		⁷ ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$	

NODE=M023W

NODE=M023W

• • • We do not use the following data for averages, fits, limits, etc. • • •

147 ± 70		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow$ $K_S^0 K_S^0 K_L^0 X$
140 ± 40		FRAME 86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
~ 220		ARMSTRONG 83	OMEG -	18.5 $K^- p \rightarrow 3K p$
~ 210		⁸ DAUM 81C	CNTR -	63 $K^- p \rightarrow K^- 2\pi p$
110 ± 50	60	CHUNG 74	HBC -	7.3 $K^- p \rightarrow K^- \omega p$
100 ± 26		BLIEDEN 72	MMS -	11-16 $K^- p$
210 ± 30	306	⁹ FIRESTONE 72B	DBC +	12 $K^+ d$
90 ± 70		¹⁰ COLLEY 71	HBC +	10 $K^+ p \rightarrow K 2\pi N$
130		DENEGRI 71	DBC -	12.6 $K^- d \rightarrow \bar{K} 2\pi d$
100 ± 50		AGUILAR-... 70C	HBC -	4.6 $K^- p$
138 ± 40		BARTSCH 70C	HBC -	10.1 $K^- p$
50 ⁺ ₋ 40 20		LUDLAM 70	HBC -	12.6 $K^- p$

⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .

⁷ From a partial wave analysis of the $K^- \omega$ system.

⁸ From a partial wave analysis of the $K^- 2\pi$ system.

⁹ Produced in conjunction with excited deuteron.

¹⁰ Systematic errors added correspond to spread of different fits.

NODE=M023W;LINKAGE=A
 NODE=M023W;LINKAGE=B
 NODE=M023W;LINKAGE=C
 NODE=M023W;LINKAGE=P
 NODE=M023W;LINKAGE=X

$K_2(1770)$ DECAY MODES

NODE=M023215;NODE=M023

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
Γ_2 $K_2^*(1430)\pi$	seen
Γ_3 $K^*(892)\pi$	seen
Γ_4 $K f_2(1270)$	seen
Γ_5 $K f_0(980)$	possibly seen
Γ_6 $K \phi$	seen
Γ_7 $K \omega$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EVAL;→ UNCHECKED ←
 DESIG=10
 DESIG=8

$K_2(1770)$ BRANCHING RATIOS

NODE=M023220

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ Γ_2/Γ_1

NODE=M023R1

$(K_2^*(1430) \rightarrow K\pi)$

NODE=M023R1
 NODE=M023R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
-------	-------------	------	-----	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.03	DAUM 81C	CNTR		63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	¹¹ FIRESTONE 72B	DBC +		12 $K^+ d$
<1.0	COLLEY 71	HBC		10 $K^+ p$
0.2 ± 0.2	AGUILAR-... 70C	HBC -		4.6 $K^- p$
<1.0	BARTSCH 70C	HBC -		10.1 $K^- p$
1.0	BARBARO-... 69	HBC +		12.0 $K^+ p$

¹¹ Produced in conjunction with excited deuteron.

NODE=M023R1;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ Γ_3/Γ_1

NODE=M023R3
 NODE=M023R3

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.23	DAUM 81C	CNTR		63 $K^- p \rightarrow K^- 2\pi p$
--------	----------	------	--	-----------------------------------

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ Γ_4/Γ_1

NODE=M023R4

$(f_2(1270) \rightarrow \pi\pi)$

NODE=M023R4
 NODE=M023R4

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.74	DAUM 81C	CNTR		63 $K^- p \rightarrow K^- 2\pi p$
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$\Gamma(K f_0(980))/\Gamma_{total}$ Γ_5/Γ

NODE=M023R6
 NODE=M023R6

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow$ $K_S^0 K_S^0 K_L^0 X$
---------------	---------------	------	---

$\Gamma(K\phi)/\Gamma_{total}$						Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	24k	12 AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi\phi K^+$	NODE=M023R5 NODE=M023R5
seen		ARMSTRONG	83	OMEG	$18.5 K^- p \rightarrow K^- \phi N$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
seen	4289	13,14 AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi\phi K^+$	NODE=M023R5;LINKAGE=C NODE=M023R5;LINKAGE=A NODE=M023R5;LINKAGE=B
12 From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 7.9 σ .						
13 From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.0 σ .						
14 Superseded by AAIJ 21E.						

$\Gamma(K\omega)/\Gamma_{total}$						Γ_7/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
seen	OTTER	81	HBC	\pm	8.25,10,16 $K^\pm p$	NODE=M023R2 NODE=M023R2
seen	CHUNG	74	HBC	$-$	7.3 $K^- p \rightarrow K^- \omega p$	

$K_2(1770)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)	
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		
Translated from YAF 66 860.					
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)	
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	
OTTER	81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)	
CHUNG	74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)	
BLIEDEN	72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)	
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)	
COLLEY	71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)	
DENEGRI	71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP	
AGUILAR...	70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)	
BARTSCH	70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)	
LUDLAM	70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)	
BARBARO...	69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)	

NODE=M023

- REFID=61150
- REFID=57657
- REFID=57636
- REFID=49653
- REFID=49423
- REFID=43597
- REFID=20569
- REFID=22801
- REFID=22548
- REFID=22549
- REFID=22735
- REFID=22788
- REFID=22506
- REFID=22785
- REFID=22497
- REFID=22782
- REFID=22783
- REFID=22784
- REFID=22483

NODE=M060

$K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

$K_3^*(1780)$ T-MATRIX POLE \sqrt{s}

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M060PP

NODE=M060PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1754 \pm 13) - i (119 \pm 14) OUR EVALUATION			
(1754 \pm 13) - i (119 \pm 14)	¹ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.			

NODE=M060PP

→ UNCHECKED ←

NODE=M060PP;LINKAGE=A

$K_3^*(1780)$ MASS

NODE=M060M

NODE=M060M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1779 \pm 8 OUR AVERAGE		Error includes scale factor of 1.2.			
1813 \pm 15 ⁺⁶⁵ / ₋₁₆	18k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1781 \pm 8 \pm 4		² ASTON	88	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
1740 \pm 14 \pm 15		² ASTON	87	LASS 0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1779 \pm 11		³ BALDI	76	SPEC +	10 $K^+ p \rightarrow K^0 \pi^+ p$
1776 \pm 26		⁴ BRANDENB...	76D	ASPK 0	13 $K^\pm p \rightarrow K^\pm \pi^\mp N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1720 \pm 10 \pm 15	6111	⁵ BIRD	89	LASS -	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1749 \pm 10		ASTON	88B	LASS -	11 $K^- p \rightarrow K^- \eta p$
1780 \pm 9	300	BAUBILLIER	84B	HBC -	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1790 \pm 15		BAUBILLIER	82B	HBC 0	8.25 $K^- p \rightarrow K_S^0 2\pi N$
1784 \pm 9	2060	CLELAND	82	SPEC \pm	50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
1786 \pm 15		⁶ ASTON	81D	LASS 0	11 $K^- p \rightarrow K^- \pi^+ n$
1762 \pm 9	190	TOAFF	81	HBC -	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1850 \pm 50		ETKIN	80	MPS 0	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
1812 \pm 28		BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786 \pm 8		CHUNG	78	MPS 0	6 $K^- p \rightarrow K^- \pi^+ n$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (2.0 \pm 0.4^{+1.9}_{-0.4}) \times 10^{-6}$.

² From energy-independent partial-wave analysis.

³ From a fit to Y_6^2 moment. $J^P = 3^-$ found.

⁴ Confirmed by phase shift analysis of ESTABROOKS 78, yields $J^P = 3^-$.

⁵ From a partial wave amplitude analysis.

⁶ From a fit to the Y_6^0 moment.

NODE=M060M;LINKAGE=D

NODE=M060M;LINKAGE=K

NODE=M060M;LINKAGE=M

NODE=M060M;LINKAGE=A

NODE=M060M;LINKAGE=F

NODE=M060M;LINKAGE=J

$K_3^*(1780)$ WIDTH

NODE=M060W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
161±17 OUR AVERAGE		Error includes scale factor of 1.1.			
191 ⁺⁴³⁺³ ₋₃₇₋₈₁	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
203±30±8		² ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
171±42±20		² ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
135±22		³ BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
187±31±20	6111	⁴ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
193 ⁺⁵¹ ₋₃₇		ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$
99±30	300	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 130		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
191±24	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
225±60		⁵ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
~ 80	190	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
240±50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
181±44		⁶ BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
96±31		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$
270±70		⁷ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

NODE=M060W

NODE=M060W;LINKAGE=A

NODE=M060W;LINKAGE=K

NODE=M060W;LINKAGE=M

NODE=M060W;LINKAGE=F

NODE=M060W;LINKAGE=J

NODE=M060W;LINKAGE=D

NODE=M060W;LINKAGE=E

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (2.0 \pm 0.4^{+1.9}_{-0.4}) \times 10^{-6}$.

² From energy-independent partial-wave analysis.

³ From a fit to Y_6^2 moment. $J^P = 3^-$ found.

⁴ From a partial wave amplitude analysis.

⁵ From a fit to Y_6^0 moment.

⁶ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁷ ESTABROOKS 78 find that BRANDENBURG 76D data are consistent with 175 MeV width. Not averaged.

$K_3^*(1780)$ DECAY MODES

NODE=M060215;NODE=M060

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\rho$	(31 ± 9) %	DESIG=3
Γ_2 $K^*(892)\pi$	(20 ± 5) %	DESIG=2
Γ_3 $K\pi$	(18.8± 1.0) %	DESIG=1
Γ_4 $K\eta$	(30 ±13) %	DESIG=6
Γ_5 $K_2^*(1430)\pi$	< 16 %	95% DESIG=4

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 4 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	85		
x_3	18	21	
x_4	-98	-94	-27
	x_1	x_2	x_3

K₃^{*}(1780) BRANCHING RATIOS

NODE=M060220

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

 Γ_1/Γ_2 NODE=M060R5
NODE=M060R5

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.52±0.23 OUR FIT				
1.52±0.21±0.10	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

 Γ_2/Γ_3 NODE=M060R7
NODE=M060R7

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.09±0.26 OUR FIT				
1.09±0.26	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

$\Gamma(K\pi)/\Gamma_{\text{total}}$

 Γ_3/Γ NODE=M060R4
NODE=M060R4

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.010 OUR FIT				
0.188±0.010 OUR AVERAGE				
0.187±0.008±0.008	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.19 ±0.02	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K\pi N$

$\Gamma(K\eta)/\Gamma(K\pi)$

 Γ_4/Γ_3 NODE=M060R8
NODE=M060R8

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.6 ±0.7 OUR FIT				

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.41±0.050	¹ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
0.50±0.18	ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$

¹ This result supersedes ASTON 88B.

NODE=M060R8;LINKAGE=H

$\Gamma(K_2^*(1430)\pi)/\Gamma(K^*(892)\pi)$

 Γ_5/Γ_2 NODE=M060R6
NODE=M060R6

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.78	95	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

K₃^{*}(1780) REFERENCES

NODE=M060

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22820
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP	REFID=22537
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP	REFID=22814
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP	REFID=22807
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22808

$K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$.

NODE=M146

NODE=M146

 $K_2(1820)$ MASS

NODE=M146M

NODE=M146M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1819 ± 12 OUR AVERAGE				
$1853 \pm 27^{+18}_{-35}$	4289	¹ AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1816 ± 13		² ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1840		³ DAUM	81C CNTR	$63 K^- p \rightarrow K^- 2\pi p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
² From a partial wave analysis of the $K^- \omega$ system.				
³ From a partial wave analysis of the $K^- 2\pi$ system.				

NODE=M146M;LINKAGE=B

NODE=M146M;LINKAGE=A

NODE=M146M;LINKAGE=C

 $K_2(1820)$ WIDTH

NODE=M146W

NODE=M146W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
264 ± 34 OUR AVERAGE				
$167 \pm 58^{+82}_{-72}$	4289	¹ AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
276 ± 35		² ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 230		³ DAUM	81C CNTR	$63 K^- p \rightarrow K^- 2\pi p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
² From a partial wave analysis of the $K^- \omega$ system.				
³ From a partial wave analysis of the $K^- 2\pi$ system.				

NODE=M146W;LINKAGE=A

NODE=M146W;LINKAGE=B

NODE=M146W;LINKAGE=C

 $K_2(1820)$ DECAY MODES

NODE=M146215;NODE=M146

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	seen
Γ_2 $K_2^*(1430) \pi$	seen
Γ_3 $K^*(892) \pi$	seen
Γ_4 $K f_2(1270)$	seen
Γ_5 $K \omega$	seen
Γ_6 $K \phi$	seen

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7

 $K_2(1820)$ BRANCHING RATIOS

NODE=M146220

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$	Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.77	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$
$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$	Γ_3/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.05	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$
$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$	Γ_4/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 0.18	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$

NODE=M146R1

NODE=M146R1

NODE=M146R2

NODE=M146R2

NODE=M146R3

NODE=M146R3

$\Gamma(K\phi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$
seen	4289	^{2,3} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$

- • • We do not use the following data for averages, fits, limits, etc. • • •
- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.8 σ .
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 3.0 σ .
³ Superseded by AAIJ 21E.

NODE=M146R00
 NODE=M146R00

NODE=M146R00;LINKAGE=B
 NODE=M146R00;LINKAGE=A
 NODE=M146R00;LINKAGE=C

$K_2(1820)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M146

REFID=61150
 REFID=57657
 REFID=57636
 REFID=49653
 REFID=43597
 REFID=22548

NODE=M088

$K(1830)$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of $K\phi$ system. Needs confirmation.

NODE=M088

$K(1830)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$1874 \pm 43^{+59}_{-115}$	4289	^{1,2} AAIJ	17C LHCB		$B^+ \rightarrow J/\psi\phi K^+$
~ 1830		ARMSTRONG 83	OMEG	-	$18.5 K^- p \rightarrow 3K p$

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 3.5 σ .
² A subsequent amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ by AAIJ 21E did not confirm this measurement.

NODE=M088M;LINKAGE=A
 NODE=M088M;LINKAGE=B

NODE=M088M

NODE=M088M

$K(1830)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$168 \pm 90^{+280}_{-104}$	4289	^{3,4} AAIJ	17C LHCB		$B^+ \rightarrow J/\psi\phi K^+$
~ 250		ARMSTRONG 83	OMEG	-	$18.5 K^- p \rightarrow 3K p$

- ³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 3.5 σ .
⁴ A subsequent amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ by AAIJ 21E did not confirm this measurement.

NODE=M088W

NODE=M088W

NODE=M088W;LINKAGE=A
 NODE=M088W;LINKAGE=B

$K(1830)$ DECAY MODES

Mode

Γ_1 $K\phi$

NODE=M088215;NODE=M088

DESIG=1

$K(1830)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)JP

NODE=M088

REFID=61150
 REFID=57657
 REFID=57636
 REFID=22801

K₀^{*}(1950)

$$I(J^P) = \frac{1}{2}(0^+)$$

Seen in partial-wave analysis of the $K^- \pi^+$ system. Needs confirmation.

NODE=M134

NODE=M134

K₀^{*}(1950) MASS

NODE=M134M

NODE=M134M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

1957 ± 14 OUR AVERAGE

1980 ± 14 ± 19	¹ AAIJ	23AH	LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
1942 ± 22 ± 21	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' K^+ K^-$
1945 ± 10 ± 20	² ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
1917 ± 12	³ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
1820 ± 40	⁴ ANISOVICH	97C	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

- • • We do not use the following data for averages, fits, limits, etc. • • •
- ¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$
- ² We take the central value of the two solutions and the larger error given.
- ³ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.
- ⁴ T-matrix pole. Reanalysis of ASTON 88 data.

NODE=M134M;LINKAGE=B
 NODE=M134M;LINKAGE=A
 NODE=M134M;LINKAGE=ZU
 NODE=M134M;LINKAGE=A1

K₀^{*}(1950) WIDTH

NODE=M134W

NODE=M134W

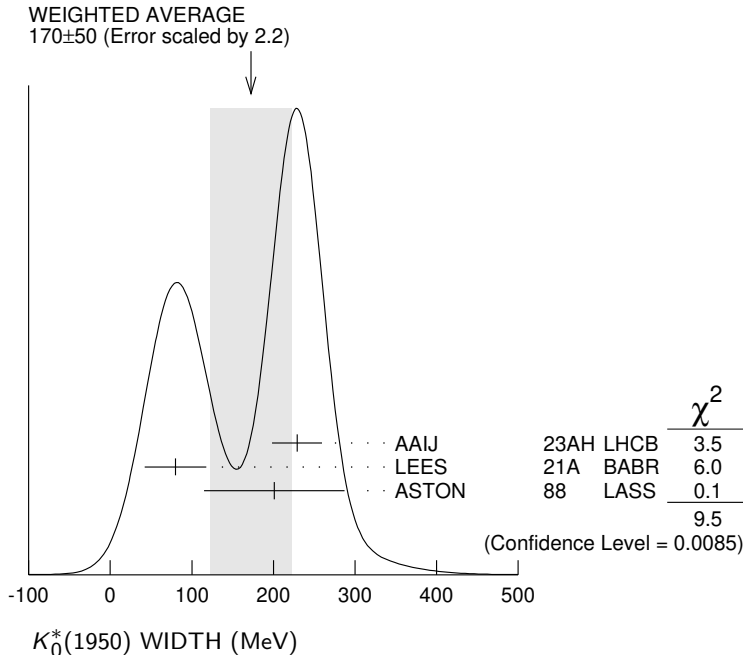
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
-------------	-------------	------	-----	---------

170 ± 50 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

229 ± 26 ± 16	¹ AAIJ	23AH	LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
80 ± 32 ± 20	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' K^+ K^-$
201 ± 34 ± 79	² ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
145 ± 38	³ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
250 ± 100	⁴ ANISOVICH	97C	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

- • • We do not use the following data for averages, fits, limits, etc. • • •
- ¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$
- ² We take the central value of the two solutions and the larger error given.
- ³ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.
- ⁴ T-matrix pole. Reanalysis of ASTON 88 data.

NODE=M134W;LINKAGE=B
 NODE=M134W;LINKAGE=A
 NODE=M134W;LINKAGE=ZU
 NODE=M134W;LINKAGE=A1



$K_0^*(1950)$ DECAY MODES

NODE=M134215;NODE=M134

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^- \pi^+$	(52±14) %

DESIG=1

 $K_0^*(1950)$ BRANCHING RATIOS

NODE=M134220

$\Gamma(K^- \pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.52±0.08±0.12	¹ ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 0.60	² ZHOU	06	RVUE		$K p \rightarrow K^- \pi^+ n$
¹ We take the central value of the two solutions and the larger error given.					
² S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.					

NODE=M134R1
NODE=M134R1NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU **$K_0^*(1950)$ REFERENCES**

NODE=M134

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

REFID=62349
REFID=61442
REFID=51198
REFID=45815
REFID=40262

NODE=M104

 $K_2^*(1980)$

$$I(J^P) = \frac{1}{2}(2^+)$$

 $K_2^*(1980)$ MASS

NODE=M104M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1990⁺⁶⁰₋₅₀	OUR AVERAGE	Error includes scale factor of 2.8. See the ideogram below.				
2046 ^{+17+₋₁₆} ₁₅	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$	
1868± 8 ^{+₋} ₄₀ ₅₇	183k	ABLIKIM	19AQBES	±	$J/\psi \rightarrow K^+ K^- \pi^0$	
1973± 8± 25		ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
2073±94 ⁺²⁴⁵ ₋₂₄₀	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$	
2020±20		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
1978±40	241	BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104M

¹Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (7.0 \pm 0.5^{+3.7}_{-0.6}) \times 10^{-6}$.

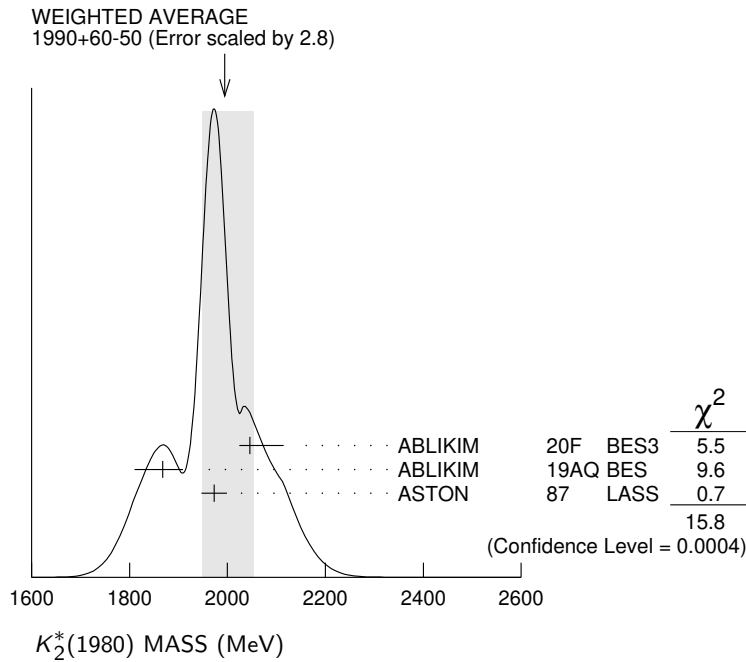
NODE=M104M;LINKAGE=C

²From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4 σ .

NODE=M104M;LINKAGE=B

³A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6 σ .

NODE=M104M;LINKAGE=E



$K_2^*(1980)$ WIDTH

NODE=M104W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
348^{+50}_{-30}	OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
408^{+38}_{-34}	$72/44$	1 ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
272 ± 24	$50/15$	183k ABLIKIM	19AQ	BES	$J/\psi \rightarrow K^+ K^- \pi^0$
373 ± 33	60	ASTON	87	LASS 0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
678 ± 311	$1153/559$	2,3 AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
180 ± 70		TIKHOMIROV 03	SPEC		$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
398 ± 47	241	BIRD	89	LASS -	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M104W

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (7.0 \pm 0.5^{+3.7}_{-0.6}) \times 10^{-6}$.

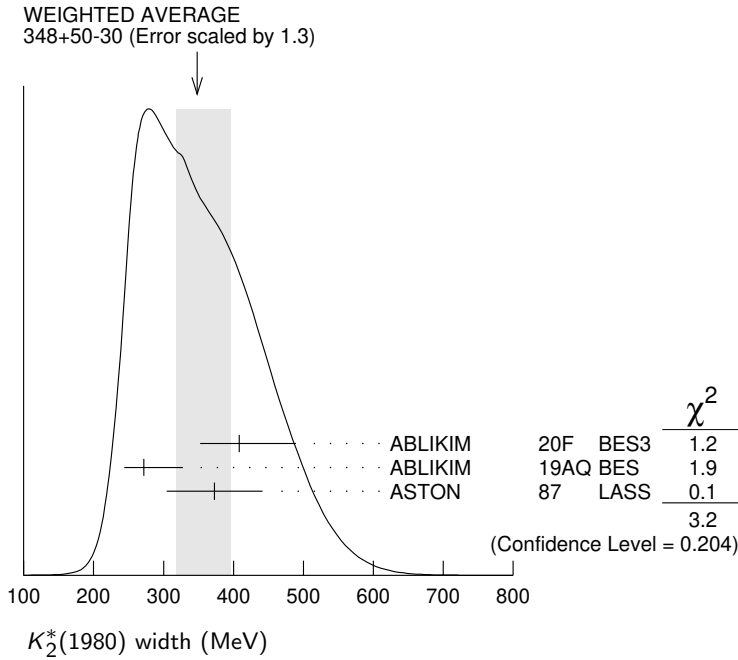
NODE=M104W;LINKAGE=C

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4σ .

NODE=M104W;LINKAGE=B

³ A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6σ .

NODE=M104W;LINKAGE=E



$K_2^*(1980)$ DECAY MODES

NODE=M104215;NODE=M104

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	possibly seen
Γ_2 $K\rho$	possibly seen
Γ_3 $K f_2(1270)$	possibly seen
Γ_4 $K\phi$	seen
Γ_5 $K\eta$	seen

DESIG=2
DESIG=3
DESIG=4
DESIG=5
DESIG=6

$K_2^*(1980)$ BRANCHING RATIOS

NODE=M104220

$\Gamma(K^*(892)\pi)/\Gamma_{total}$ Γ_1/Γ

NODE=M104R01
NODE=M104R01

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	GULER	11	BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

$\Gamma(K\rho)/\Gamma_{total}$ Γ_2/Γ

NODE=M104R02
NODE=M104R02

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	GULER	11	BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_2/Γ_1

NODE=M104R1
NODE=M104R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
$1.49 \pm 0.24 \pm 0.09$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

$\Gamma(K f_2(1270))/\Gamma_{total}$ Γ_3/Γ

NODE=M104R3
NODE=M104R3

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

$\Gamma(K\phi)/\Gamma_{total}$ Γ_4/Γ

NODE=M104R00
NODE=M104R00

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	4289	1,2 AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4σ .

NODE=M104R00;LINKAGE=A
NODE=M104R00;LINKAGE=C

² A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6σ .

$\Gamma(K\eta)/\Gamma_{total}$ Γ_5/Γ

NODE=M104R03
NODE=M104R03

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	1.8k	¹ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
seen	116k	² CHEN	20A BELL	$D^0 \rightarrow K^- \pi^+ \eta$

¹ Seen decaying to $K\eta$ in an amplitude analysis of $\psi(2S) \rightarrow K^+ K^- \eta$.

NODE=M104R03;LINKAGE=A
NODE=M104R03;LINKAGE=B

² From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 17σ .

$K_2^*(1980)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)	REFID=60333
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57657
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57636
GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)	REFID=53668
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234

NODE=M104

REFID=61150
REFID=60256
REFID=60333
REFID=59909
REFID=57657
REFID=57636
REFID=53668
REFID=49423REFID=41002
REFID=40234

NODE=M035

 $K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

 $K_4^*(2045)$ MASS

NODE=M035M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2048⁺⁸₋₉	OUR AVERAGE	Error includes scale factor of 1.1.			
2090 [±]	9 ⁺¹¹ ₋₂₉	183k	ABLIKIM	19AQ BES	± $J/\psi \rightarrow K^+ K^- \pi^0$
2062 [±]	14 [±] 13		¹ ASTON	86 LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
2039 [±]	10	400	^{2,3} CLELAND	82 SPEC	± $50 K^+ p \rightarrow K_S^0 \pi^\pm p$
2070 ⁺¹⁰⁰ ₋₄₀			⁴ ASTON	81C LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2079 [±]	7	431	TORRES	86 MPSF	400 $pA \rightarrow 4KX$
2088 [±]	20	650	BAUBILLIER	82 HBC	- $8.25 K^- p \rightarrow K_S^0 \pi^- p$
2115 [±]	46	488	CARMONY	77 HBC	0 $9 K^+ d \rightarrow K^+ \pi^+ s X$

NODE=M035M

¹ From a fit to all moments.² From a fit to 8 moments.³ Number of events evaluated by us.⁴ From energy-independent partial-wave analysis.NODE=M035M;LINKAGE=E
NODE=M035M;LINKAGE=B
NODE=M035M;LINKAGE=W
NODE=M035M;LINKAGE=D **$K_4^*(2045)$ WIDTH**

NODE=M035W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
199⁺²⁷₋₁₉	OUR AVERAGE				
201 [±]	19 ⁺⁵⁷ ₋₁₇	183k	ABLIKIM	19AQ BES	± $J/\psi \rightarrow K^+ K^- \pi^0$
221 [±]	48 [±] 27		⁵ ASTON	86 LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
189 [±]	35	400	^{6,7} CLELAND	82 SPEC	± $50 K^+ p \rightarrow K_S^0 \pi^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
61 [±]	58	431	TORRES	86 MPSF	400 $pA \rightarrow 4KX$
170 ⁺¹⁰⁰ ₋₅₀		650	BAUBILLIER	82 HBC	- $8.25 K^- p \rightarrow K_S^0 \pi^- p$
240 ⁺⁵⁰⁰ ₋₁₀₀			⁸ ASTON	81C LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
300 [±] 200			CARMONY	77 HBC	0 $9 K^+ d \rightarrow K^+ \pi^+ s X$

NODE=M035W

⁵ From a fit to all moments.⁶ From a fit to 8 moments.⁷ Number of events evaluated by us.⁸ From energy-independent partial-wave analysis.NODE=M035W;LINKAGE=E
NODE=M035W;LINKAGE=B
NODE=M035W;LINKAGE=W
NODE=M035W;LINKAGE=D **$K_4^*(2045)$ DECAY MODES**

NODE=M035215;NODE=M035

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(9.9 \pm 1.2) %
Γ_2 $K^*(892)\pi\pi$	(9 \pm 5) %
Γ_3 $K^*(892)\pi\pi\pi$	(7 \pm 5) %
Γ_4 $\rho K\pi$	(5.7 \pm 3.2) %
Γ_5 $\omega K\pi$	(5.0 \pm 3.0) %
Γ_6 $\phi K\pi$	(2.8 \pm 1.4) %
Γ_7 $\phi K^*(892)$	(1.4 \pm 0.7) %

DESIG=1

DESIG=2

DESIG=5

DESIG=3

DESIG=4

DESIG=6

DESIG=7

$K_4^*(2045)$ BRANCHING RATIOS

NODE=M035220

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.099±0.012	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M035R1
NODE=M035R1

$\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.89±0.53	BAUBILLIER	82	HBC	- 8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R2
NODE=M035R2

$\Gamma(K^*(892)\pi\pi\pi)/\Gamma(K\pi)$					Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.75±0.49	BAUBILLIER	82	HBC	- 8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R5
NODE=M035R5

$\Gamma(\rho K\pi)/\Gamma(K\pi)$					Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.58±0.32	BAUBILLIER	82	HBC	- 8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R3
NODE=M035R3

$\Gamma(\omega K\pi)/\Gamma(K\pi)$					Γ_5/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.50±0.30	BAUBILLIER	82	HBC	- 8.25 $K^- p \rightarrow p K_S^0 3\pi$	

NODE=M035R4
NODE=M035R4

$\Gamma(\phi K\pi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.028±0.014	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$	

NODE=M035R6
NODE=M035R6

$\Gamma(\phi K^*(892))/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.014±0.007	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$	

NODE=M035R7
NODE=M035R7⁹ Error determination is model dependent.

NODE=M035R;LINKAGE=A

 $K_4^*(2045)$ REFERENCES

NODE=M035

ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=22462
TORRES	86	PR D34 707	S. Torres <i>et al.</i>	(VPI, ARIZ, FNAL, FSU+)	REFID=22845
BAUBILLIER	82	PL 118B 447	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22842
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22821
CARMONY	77	PR D16 1251	D.D. Carmony <i>et al.</i>	(PURD, UCD, IUPU)	REFID=22811

$K_2(2250)$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE

This entry contains various peaks in strange meson systems reported in the 2150–2260 MeV region, as well as enhancements seen in the antihyperon-nucleon system, either in the mass spectra or in the $J^P = 2^-$ wave.

NODE=M040

NODE=M040

 $K_2(2250)$ MASS

NODE=M040M

NODE=M040M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
2247±17 OUR AVERAGE						
2200±40		¹ ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$	
2235±50		¹ BAUBILLIER 81	HBC	-	8 $K^- p \rightarrow \Lambda \bar{p} X$	
2260±20		¹ CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
2280±20		TIKHOMIROV 03	SPEC		40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
2147±4	37	CHLIAPNIK...	79	HBC	+	32 $K^+ p \rightarrow \bar{\Lambda} p X$
2240±20	20	LISSAUER 70	HBC		9 $K^+ p$	
¹ $J^P = 2^-$ from moments analysis.						

NODE=M040M;LINKAGE=Q

 $K_2(2250)$ WIDTH

NODE=M040W

NODE=M040W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
180±30 OUR AVERAGE						
Error includes scale factor of 1.4.						
150±30		² ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$	
210±30		² CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
180±60		TIKHOMIROV 03	SPEC		40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 200		² BAUBILLIER 81	HBC	-	8 $K^- p \rightarrow \Lambda \bar{p} X$	
~ 40	37	CHLIAPNIK...	79	HBC	+	32 $K^+ p \rightarrow \bar{\Lambda} p X$
80±20	20	LISSAUER 70	HBC		9 $K^+ p$	
² $J^P = 2^-$ from moments analysis.						

NODE=M040W;LINKAGE=Q

 $K_2(2250)$ DECAY MODES

NODE=M040215;NODE=M040

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K f_2(1270)$
Γ_3	$K^*(892) f_0(980)$
Γ_4	$\rho \bar{\Lambda}$

DESIG=1

DESIG=3

DESIG=4

DESIG=2

 $K_2(2250)$ REFERENCES

NODE=M040

REFID=49423

TIKHOMIROV 03	PAN 66 828 Translated from YAF 66 860.	G.D. Tikhomirov <i>et al.</i>	
ARMSTRONG 83C	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
BAUBILLIER 81	NP B183 1	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+) JP
CLELAND 81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+) JP
CHLIAPNIK...	NP B158 253	P.V. Chliapnikov <i>et al.</i>	(CERN, BELG, MONS)
LISSAUER 70	NP B18 491	D. Lissauer <i>et al.</i>	(LBL)

REFID=22852

REFID=22850

REFID=22851

REFID=22849

REFID=22847

$K_3(2320)$

$$I(J^P) = \frac{1}{2}(3^+)$$

OMITTED FROM SUMMARY TABLE

Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

NODE=M090

NODE=M090

 $K_3(2320)$ MASS

NODE=M090M

NODE=M090M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2324 ± 24 OUR AVERAGE				
2330 ± 40	¹ ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$
2320 ± 30	¹ CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$

¹ $J^P = 3^+$ from moments analysis.

NODE=M090M;LINKAGE=P

 $K_3(2320)$ WIDTH

NODE=M090W

NODE=M090W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150 ± 30	² ARMSTRONG 83C	OMEG	-	18 $K^- p \rightarrow \Lambda \bar{p} X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	² CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$

² $J^P = 3^+$ from moments analysis.

NODE=M090W;LINKAGE=P

 $K_3(2320)$ DECAY MODES

NODE=M090215;NODE=M090

Mode

 $\Gamma_1 \quad p \bar{\Lambda}$

DESIG=1

 $K_3(2320)$ REFERENCES

NODE=M090

ARMSTRONG 83C NP B227 365 T.A. Armstrong *et al.* (BARI, BIRM, CERN+)
CLELAND 81 NP B184 1 W.E. Cleland *et al.* (PITT, GEVA, LAUS+)

REFID=22852
REFID=22851

NODE=M098

 $K_5^*(2380)$

$$I(J^P) = \frac{1}{2}(5^-)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M098

 $K_5^*(2380)$ MASS

NODE=M098M

NODE=M098M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2382 ± 14 ± 19	¹ ASTON 86	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

¹ From a fit to all the moments.

NODE=M098M;LINKAGE=E

 $K_5^*(2380)$ WIDTH

NODE=M098W

NODE=M098W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
178 ± 37 ± 32	² ASTON 86	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

² From a fit to all the moments.

NODE=M098W;LINKAGE=E

 $K_5^*(2380)$ DECAY MODES

NODE=M098215;NODE=M098

Mode

Fraction (Γ_i/Γ) $\Gamma_1 \quad K \pi$

(6.1 ± 1.2) %

DESIG=1

 $K_5^*(2380)$ BRANCHING RATIOS

NODE=M098220

 $\Gamma(K\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.061 ± 0.012	ASTON 88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M098R1
NODE=M098R1

$K_5^*(2380)$ REFERENCES

ASTON 88 NP B296 493 D. Aston *et al.* (SLAC, NAGO, CINC, INUS)
 ASTON 86 PL B180 308 D. Aston *et al.* (SLAC, NAGO, CINC, INUS)

NODE=M098

REFID=40262
REFID=22462

NODE=M091

 $K_4(2500)$

$$I(J^P) = \frac{1}{2}(4^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M091

 $K_4(2500)$ MASS

NODE=M091M

NODE=M091M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2490 ± 20	¹ CLELAND	81	SPEC \pm	50 $K^+ p \rightarrow \Lambda \bar{p}$

¹ $J^P = 4^-$ from moments analysis.

NODE=M091M;LINKAGE=R

 $K_4(2500)$ WIDTH

NODE=M091W

NODE=M091W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
~ 250	² CLELAND	81	SPEC \pm	50 $K^+ p \rightarrow \Lambda \bar{p}$

• • • We do not use the following data for averages, fits, limits, etc. • • •
² $J^P = 4^-$ from moments analysis.

NODE=M091W;LINKAGE=R

 $K_4(2500)$ DECAY MODES

NODE=M091215;NODE=M091

Mode

 $\Gamma_1 \quad p \bar{\Lambda}$

DESIG=1

 $K_4(2500)$ REFERENCES

CLELAND 81 NP B184 1 W.E. Cleland *et al.* (PITT, GEVA, LAUS+)

NODE=M091

REFID=22851

NODE=M129

 $K(3100)$

$$I^G(J^{PC}) = ?^?(?^{??})$$

OMITTED FROM SUMMARY TABLE
also known as $K_J^?(3100)$

Narrow peak observed in several ($\Lambda \bar{p} +$ pions) and ($\bar{\Lambda} p +$ pions) states in Σ^- Be reactions by BOURQUIN 86 and in np and nA reactions by ALEEV 93. Not seen by BOEHNLEIN 91. If due to strong decays, this state has exotic quantum numbers ($B=0, Q=+1, S=-1$ for $\Lambda \bar{p} \pi^+ \pi^+$ and $I \geq 3/2$ for $\Lambda \bar{p} \pi^-$). Needs confirmation.

NODE=M129

 $K(3100)$ MASS

NODE=M129205

VALUE (MeV)	DOCUMENT ID
≈ 3100 OUR ESTIMATE	

NODE=M129M
→ UNCHECKED ←**3-BODY DECAYS**NODE=M129M1
NODE=M129M1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3054 ± 11 OUR AVERAGE			
$3060 \pm 7 \pm 20$	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+$
$3056 \pm 7 \pm 20$	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^-$
$3055 \pm 8 \pm 20$	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^-$
$3045 \pm 8 \pm 20$	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3059±11 OUR AVERAGE			
3067± 6±20	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
3060± 8±20	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
3055± 7±20	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^- \pi^-$
3052± 8±20	¹ ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3105±30	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
3115±30	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^-$

NODE=M129M2
NODE=M129M2OCCUR=2
OCCUR=3
OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3095±30	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
¹ Supersedes ALEEV 90.			

NODE=M129M3
NODE=M129M3

NODE=M129M;LINKAGE=A

K(3100) WIDTH

NODE=M129210

3-BODY DECAYS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
42±16	² ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+$
36±15	² ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^-$
50±18	² ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^-$
30±15	² ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^+$

NODE=M129W1
NODE=M129W1OCCUR=2
OCCUR=3
OCCUR=4**4-BODY DECAYS**

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22± 8		² ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
28±12		² ALEEV	93	BIS2 $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
32±15		² ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^- \pi^-$
30±15		² ALEEV	93	BIS2 $K(3100) \rightarrow \bar{\Lambda} p \pi^- \pi^+$
<30	90	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
<80	90	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^-$

NODE=M129W2
NODE=M129W2OCCUR=2
OCCUR=3
OCCUR=4

OCCUR=2

5-BODY DECAYS

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	90	BOURQUIN	86	SPEC $K(3100) \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
² Supersedes ALEEV 90.				

NODE=M129W3
NODE=M129W3

NODE=M129W;LINKAGE=A

K(3100) DECAY MODES

NODE=M129215;NODE=M129

Mode	
Γ_1	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+$
Γ_2	$K(3100)^{--} \rightarrow \Lambda \bar{p} \pi^-$
Γ_3	$K(3100)^- \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
Γ_4	$K(3100)^+ \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
Γ_5	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
Γ_6	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

DESIG=1
DESIG=2
DESIG=3
DESIG=4
DESIG=5
DESIG=6 **$\Gamma(\Sigma(1385)^+ \bar{p})/\Gamma(\Lambda \bar{p} \pi^+)$** **$\Gamma_6/\Gamma_1$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	ALEEV	93	BIS2 $K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

NODE=M129R1
NODE=M129R1**K(3100) REFERENCES**

NODE=M129

ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
		Translated from YAF 56 100.		
BOEHNLEIN	91	NPBPS B21 174	A. Boehnlein <i>et al.</i>	(FLOR, BNL, IND+)
ALEEV	90	ZPHY C47 533	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
BOURQUIN	86	PL B172 113	M.H. Bourquin <i>et al.</i>	(GEVA, RAL, HEIDP+)

REFID=43668
REFID=41743
REFID=42173
REFID=22928

CHARMED MESONS

(C = ±1)

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}\text{'s}$$

$D^*(2007)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

$J^P = 1^-$ established by ABLIKIM 23AZ.

$D^*(2007)^0$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2006.85 ± 0.05 OUR FIT	Error includes scale factor of 1.1.		
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2006 ± 1.5	¹ GOLDHABER 77	MRK1	e^+e^-
¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+,$ and D^0 .			

$m_{D^*(2007)^0} = m_{D^0}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
142.014 ± 0.030 OUR FIT	Error includes scale factor of 1.5.			
142.016 ± 0.030 OUR AVERAGE	Error includes scale factor of 1.5.			
142.007 ± 0.015 ± 0.014	10k	¹ TOMARADZE 15	CLEO	$e^+e^- \rightarrow$ hadrons
142.2 ± 0.3 ± 0.2	145	ALBRECHT 95F	ARG	$e^+e^- \rightarrow$ hadrons
142.12 ± 0.05 ± 0.05	1176	BORTOLETTO92B	CLE2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
142.2 ± 2.0		SADROZINSKI 80	CBAL	$D^{*0} \rightarrow D^0\pi^0$
142.7 ± 1.7		² GOLDHABER 77	MRK1	e^+e^-
¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. This value comes from the average of the results for two decay modes, $D^0 \rightarrow K^-\pi^+$ and $D^0 \rightarrow K^-\pi^+\pi^-\pi^+$.				
² From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+,$ and D^0 .				

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ ABACHI 88B	HRS	$D^{*0} \rightarrow D^+\pi^-$
¹ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.				

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^0\pi^0$	(64.7 ± 0.9) %	DESIG=1
Γ_2 $D^0\gamma$	(35.3 ± 0.9) %	DESIG=2
Γ_3 $D^0e^+e^-$	(3.91 ± 0.33) × 10 ⁻³	DESIG=3
Γ_4 $\mu^+\mu^-$	< 2.5 × 10 ⁻⁸	90% DESIG=4
Γ_5 e^+e^-	< 1.7 × 10 ⁻⁶	90% DESIG=5

NODE=MXXX035

NODE=MXXX035

NODE=M061

NODE=M061

NODE=M061M

NODE=M061M

NODE=M061M

NODE=M061M;LINKAGE=G

NODE=M061DM

NODE=M061DM

NODE=M061DM

NODE=M061DM;LINKAGE=A

NODE=M061DM;LINKAGE=G

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

NODE=M061220;NODE=M061

NODE=M061

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 5 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 2.5$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_2 \begin{vmatrix} & -100 \\ & \\ x_1 & \end{vmatrix}$$

$D^*(2007)^0$ BRANCHING RATIOS

NODE=M061225

$\Gamma(D^0 \pi^0) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

NODE=M061R2
NODE=M061R2**0.647 ± 0.009 OUR FIT**

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.655 ± 0.008 ± 0.005	3.2k	¹ ABLIKIM	15B BES3	$e^+ e^- \rightarrow \text{hadrons}$
0.635 ± 0.003 ± 0.017	69k	¹ AUBERT, BE	05G BABR	10.6 $e^+ e^- \rightarrow \text{hadrons}$
0.596 ± 0.035 ± 0.028	858	² ALBRECHT	95F ARG	$e^+ e^- \rightarrow \text{hadrons}$
0.636 ± 0.023 ± 0.033	1097	² BUTLER	92 CLE2	$e^+ e^- \rightarrow \text{hadrons}$

¹ Derived from the ratio $\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0 \pi^0$ and $D^{*0} \rightarrow D^0 \gamma$ decays sum to 100%.

NODE=M061R2;LINKAGE=AU

² The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R2;LINKAGE=A

$\Gamma(D^0 \gamma) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-------	------	-------------	------	---------

NODE=M061R1
NODE=M061R1**0.353 ± 0.009 OUR FIT****0.381 ± 0.029 OUR AVERAGE**

0.404 ± 0.035 ± 0.028	456	¹ ALBRECHT	95F ARG	$e^+ e^- \rightarrow \text{hadrons}$
0.364 ± 0.023 ± 0.033	621	¹ BUTLER	92 CLE2	$e^+ e^- \rightarrow \text{hadrons}$
0.37 ± 0.08 ± 0.08		ADLER	88D MRK3	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.345 ± 0.008 ± 0.005	1.8k	² ABLIKIM	15B BES3	$e^+ e^- \rightarrow \text{hadrons}$
0.365 ± 0.003 ± 0.017	68k	² AUBERT, BE	05G BABR	10.6 $e^+ e^- \rightarrow \text{hadrons}$
0.47 ± 0.23		LOW	87 HRS	29 GeV $e^+ e^-$
0.53 ± 0.13		BARTEL	85G JADE	$e^+ e^-$, hadrons
0.47 ± 0.12		COLES	82 MRK2	$e^+ e^-$
0.45 ± 0.15		GOLDHABER	77 MRK1	$e^+ e^-$

¹ The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R;LINKAGE=A

² Derived from the ratio $\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0 \pi^0$ and $D^{*0} \rightarrow D^0 \gamma$ decays sum to 100%.

NODE=M061R;LINKAGE=AU

$\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ Γ_1 / Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M061R3
NODE=M061R3**1.83 ± 0.07 OUR FIT****1.85 ± 0.07 OUR AVERAGE**

1.90 ± 0.07 ± 0.05	4.9k	ABLIKIM	15B BES3	10.6 $e^+ e^- \rightarrow \text{hadrons}$
1.74 ± 0.02 ± 0.13		AUBERT, BE	05G BABR	10.6 $e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.789 ± 0.082		¹ AAIJ	22N LHCb	$B^0, B_S^0 \rightarrow \bar{D}^{*0} (K \pi, \pi \pi)$
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¹ Statistical error only.

NODE=M061R3;LINKAGE=A

$\Gamma(D^0 e^+ e^-) / \Gamma(D^0 \gamma)$ Γ_3 / Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

NODE=M061R00
NODE=M061R00**11.08 ± 0.76 ± 0.49** 421 ABLIKIM 21BD BES3 4.178 GeV $e^+ e^-$

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.5 \times 10^{-8}$	90	¹ AAIJ	23D LHCB	$B^- \rightarrow \pi^- \mu^+ \mu^-$

¹ AAIJ 23D reports $< 2.6 \times 10^{-8}$ from a measurement of $[\Gamma(D^*(2007)^0 \rightarrow \mu^+ \mu^-) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow \bar{D}^*(2007)^0 \pi^+)]$ assuming $B(B^+ \rightarrow \bar{D}^*(2007)^0 \pi^+) = (4.90 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $B(B^+ \rightarrow \bar{D}^*(2007)^0 \pi^+) = 5.17 \times 10^{-3}$. The reported value also assumes $B(B^- \rightarrow J/\psi(1S) K^-) = (10.20 \pm 0.19) \times 10^{-4}$ and $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (59.61 \pm 0.33) \times 10^{-3}$ for the normalization mode $B^- \rightarrow J/\psi(1S) K^-$.

NODE=M061R01
 NODE=M061R01

NODE=M061R01;LINKAGE=A

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-6}$	90	SHEMYAKIN	20 CMD3	$e^+ e^- \rightarrow D^0 \pi^0, D^0 \gamma$

NODE=M061R02
 NODE=M061R02

 $D^*(2007)^0$ REFERENCES

AAIJ	23D	EPJ C83 666	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62095
ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=62420
AAIJ	22N	PR D105 072005	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61737
ABLIKIM	21BD	PR D104 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61535
SHEMYAKIN	20	PAN 83 954	D.N. Shemyakin	(CMD-3 Collab.)	REFID=62315
ABLIKIM	15B	PR D91 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56375
TOMARADZE	15	PR D91 011102	A. Tomaradze <i>et al.</i>	(NWES)	REFID=57142
AUBERT,BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50942
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44374
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)	REFID=43116
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43170
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)	REFID=40584
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40579
LOW	87	PL B183 232	E.H. Low <i>et al.</i>	(HRS Collab.)	REFID=40017
BARTEL	85G	PL 161B 197	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=22880
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)	REFID=22866
SADROZINSKI	80	Madison Conf. 681	H.F.W. Sadrozinski <i>et al.</i>	(PRIN, CIT+)	REFID=22877
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)	REFID=11434

NODE=M061

REFID=62095
 REFID=62420
 REFID=61737
 REFID=61535
 REFID=62315
 REFID=56375
 REFID=57142
 REFID=50942
 REFID=44374
 REFID=43116
 REFID=43170
 REFID=40584
 REFID=40579
 REFID=40017
 REFID=22880
 REFID=22866
 REFID=22877
 REFID=11434

 $D^*(2010)^\pm$

$$I(J^P) = \frac{1}{2}(1^-)$$

$J^P = 1^-$ established by ABLIKIM 23AZ.

NODE=M062

NODE=M062

 $D^*(2010)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062M

NODE=M062M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2010.26 ± 0.05 OUR FIT				

NODE=M062M

• • • We do not use the following data for averages, fits, limits, etc. • • •

2008 ± 3	¹ GOLDHABER	77	MRK1 ±	$e^+ e^-$
2008.6 ± 1.0	² PERUZZI	77	LGW ±	$e^+ e^-$

¹ From simultaneous fit to $D^*(2010)^+, D^*(2007)^0, D^+,$ and D^0 ; not independent of FELDMAN 77B mass difference below.

NODE=M062M;LINKAGE=G

² PERUZZI 77 mass not independent of FELDMAN 77B mass difference below and PERUZZI 77 D^0 mass value.

NODE=M062M;LINKAGE=P

 $m_{D^*(2010)^+} - m_{D^+}$

NODE=M062MD

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
140.603 ± 0.015 OUR FIT				

NODE=M062MD

140.602 ± 0.014 OUR AVERAGE

140.6010 ± 0.0068 ± 0.0129	151k	LEES	17F BABR	$e^+ e^- \rightarrow$ hadrons
140.64 ± 0.08 ± 0.06	620	BORTOLETTO92B	CLE2	$e^+ e^- \rightarrow$ hadrons

 $m_{D^*(2010)^+} = m_{D^0}$

NODE=M062DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
145.4258±0.0017 OUR FIT				
145.4258±0.0020 OUR AVERAGE Error includes scale factor of 1.2.				
145.4259±0.0004±0.0017	312.8k	LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K\pi, K3\pi)\pi^\pm$
145.412 ±0.002 ±0.012		ANASTASSOV 02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K\pi)\pi^\pm$
145.54 ±0.08	611	¹ ADINOLFI 99	BEAT	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.45 ±0.02		¹ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K\pi)\pi^\pm$
145.42 ±0.05		¹ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^-3\pi)\pi^\pm$
145.5 ±0.15	103	² ADLOFF 97B	H1	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.44 ±0.08	152	² BREITWEG 97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$
145.42 ±0.11	199	² BREITWEG 97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$ $D^0 \rightarrow K^-3\pi,$
145.4 ±0.2	48	² DERRICK 95	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$ $D^0 \rightarrow K^- \pi^+$
145.39 ±0.06 ±0.03		BARLAG 92B	ACCM	π^- 230 GeV
145.5 ±0.2	115	² ALEXANDER 91B	OPAL	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.30 ±0.06		² DECAMP 91J	ALEP	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.40 ±0.05 ±0.10		ABACHI 88B	HRS	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.46 ±0.07 ±0.03		ALBRECHT 85F	ARG	$D^{*\pm} \rightarrow D^0 \pi^+$
145.5 ±0.3	28	BAILEY 83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.3	60	FITCH 81	SPEC	π^- A
145.3 ±0.5	30	FELDMAN 77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
145.4256±0.0006±0.0017	138.5k	LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+)\pi^\pm$
145.4266±0.0005±0.0019	174.3k	LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-)\pi^\pm$
145.44 ±0.09	122	² BREITWEG 97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$ $D^0 \rightarrow K^- \pi^+$
145.8 ±1.5	16	AHLEN 83	HRS	$D^{*+} \rightarrow D^0 \pi^+$
145.1 ±1.8	12	BAILEY 83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.1 ±0.5	14	BAILEY 83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.5	14	YELTON 82	MRK2	$29 e^+ e^- \rightarrow K^- \pi^+$
~ 145.5		AVERY 80	SPEC	γ A
145.2 ±0.6	2	BLIETSCHAU 79	BEBC	νp

NODE=M062DM

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

NODE=M062DM;LINKAGE=AV
NODE=M062DM;LINKAGE=A

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

NODE=M062EM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2.6±1.8	¹ PERUZZI 77	LGW	$e^+ e^-$
¹ Not independent of FELDMAN 77B mass difference above, PERUZZI 77 D^0 mass, and GOLDHABER 77 $D^*(2007)^0$ mass.			

NODE=M062EM

NODE=M062EM;LINKAGE=P

$D^*(2010)^\pm$ WIDTH

NODE=M062W

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
83.4±1.8 OUR AVERAGE					
83.3±1.2± 1.4	1.4	312.8k	¹ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K\pi, K3\pi)\pi^\pm$
96 ±4 ±22			¹ ANASTASSOV 02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K\pi)\pi^\pm$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
83.4±1.7± 1.5	1.5	138.5k	¹ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+)\pi^\pm$
83.2±1.5± 2.6	2.6	174.3k	¹ LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-)\pi^\pm$
<131	90	110	BARLAG 92B	ACCM	π^- 230 GeV
¹ Ignoring the electromagnetic contribution from $D^{*\pm} \rightarrow D^\pm \gamma.$					

NODE=M062W

OCCUR=3

OCCUR=2

NODE=M062W;LINKAGE=LE

$D^*(2010)^\pm$ DECAY MODES $D^*(2010)^-$ modes are charge conjugates of the modes below.

NODE=M062225;NODE=M062

NODE=M062

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^0\pi^+$	(67.7±0.5) %	
Γ_2 $D^+\pi^0$	(30.7±0.5) %	
Γ_3 $D^+\gamma$	(1.6±0.4) %	
Γ_4 $e^+\nu_e$	< 1.1 $\times 10^{-5}$	90%
Γ_5 $\mu^+\nu_\mu$	< 4.3 $\times 10^{-6}$	90%

DESIG=1

DESIG=3

DESIG=2

DESIG=5

DESIG=6

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.3$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-62	
x_3	-43	-44
	x_1	x_2

 $D^*(2010)^+$ BRANCHING RATIOS

NODE=M062230

$\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
0.677 ± 0.005 OUR FIT						
0.677 ± 0.006 OUR AVERAGE						
0.6759 ± 0.0029 ± 0.0064	^{1,2,3} BARTELT	98	CLE2	e^+e^-		
0.688 ± 0.024 ± 0.013	ALBRECHT	95F	ARG	$e^+e^- \rightarrow \text{hadrons}$		
0.681 ± 0.010 ± 0.013	¹ BUTLER	92	CLE2	$e^+e^- \rightarrow \text{hadrons}$		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.57 ± 0.04 ± 0.04	ADLER	88D	MRK3	e^+e^-		
0.44 ± 0.10	COLES	82	MRK2	e^+e^-		
0.6 ± 0.15	³ GOLDHABER	77	MRK1	e^+e^-		

NODE=M062R1
NODE=M062R1

¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

³ Assuming that isospin is conserved in the decay.

NODE=M062R1;LINKAGE=A

NODE=M062R1;LINKAGE=B

NODE=M062R1;LINKAGE=G

$\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.307 ± 0.005 OUR FIT						
0.3073 ± 0.0013 ± 0.0062						
	^{1,2,3}	BARTELT	98	CLE2	e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.312 ± 0.011 ± 0.008	1404	ALBRECHT	95F	ARG	$e^+e^- \rightarrow \text{hadrons}$	
0.308 ± 0.004 ± 0.008	410	¹ BUTLER	92	CLE2	$e^+e^- \rightarrow \text{hadrons}$	
0.26 ± 0.02 ± 0.02		ADLER	88D	MRK3	e^+e^-	
0.34 ± 0.07		COLES	82	MRK2	e^+e^-	

NODE=M062R3
NODE=M062R3

¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

³ Assuming that isospin is conserved in the decay.

NODE=M062R3;LINKAGE=A

NODE=M062R3;LINKAGE=B

NODE=M062R3;LINKAGE=G

$\Gamma(D^+\gamma)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
-------	-----	------	-------------	------	---------

0.016 ± 0.004 OUR FIT**0.016 ± 0.005 OUR AVERAGE**

0.0168 ± 0.0042 ± 0.0029

1,2 BARTELT 98 CLE2 e⁺e⁻

0.011 ± 0.014 ± 0.016

12 1 BUTLER 92 CLE2 e⁺e⁻ → hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.052

90

ALBRECHT 95F ARG e⁺e⁻ → hadrons

0.17 ± 0.05 ± 0.05

ADLER 88D MRK3 e⁺e⁻

0.22 ± 0.12

3 COLES 82 MRK2 e⁺e⁻¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.³ Not independent of $\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$ and $\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$ measurement.NODE=M062R2
NODE=M062R2

NODE=M062R2;LINKAGE=A

NODE=M062R2;LINKAGE=B

NODE=M062R2;LINKAGE=C

 $\Gamma(e^+\nu_e)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

<1.1 × 10⁻⁵

90

ABLIKIM 24AO BES3 e⁺e⁻ at 4.178–4.226 GeVNODE=M062R00
NODE=M062R00 $\Gamma(\mu^+\nu_\mu)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

<4.3 × 10⁻⁶

90

ABLIKIM 24AO BES3 e⁺e⁻ at 4.178–4.226 GeVNODE=M062R01
NODE=M062R01**D*(2010)[±] REFERENCES**

NODE=M062

ABLIKIM	24AO	PR D110 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62703
ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=62420
LEES	17F	PRL 119 202003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58277
LEES	13X	PRL 111 111801	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55564
Also		PR D88 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55547
Also		PR D88 079902 (err.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55695
ANASTASSOV	02	PR D65 032003	A. Anastassov <i>et al.</i>	(CLEO Collab.)	REFID=48550
ADINOLFI	99	NP B547 3	M. Adinolfi <i>et al.</i>	(Beatrice Collab.)	REFID=46925
BREITWEG	99	EPJ C6 67	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46604
BARTELT	98	PRL 80 3919	J. Bartelt <i>et al.</i>	(CLEO Collab.)	REFID=46349
ADLOFF	97B	ZPHY C72 593	C. Adloff <i>et al.</i>	(H1 Collab.)	REFID=45421
BREITWEG	97	PL B401 192	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=45520
BREITWEG	97B	PL B407 402	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=45699
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44374
DERRICK	95	PL B349 225	M. Derrick <i>et al.</i>	(ZEUS Collab.)	REFID=44373
BARLAG	92B	PL B278 480	S. Barlag <i>et al.</i>	(ACCMOR Collab.)	REFID=42174
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)	REFID=43116
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43170
ALEXANDER	91B	PL B262 341	G. Alexander <i>et al.</i>	(OPAL Collab.)	REFID=41553
DECAMP	91J	PL B266 218	D. Decamp <i>et al.</i>	(ALEPH Collab.)	REFID=41614
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)	REFID=40584
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40579
ALBRECHT	85F	PL 150B 235	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=11527
AHLEN	83	PRL 51 1147	S.P. Ahlen <i>et al.</i>	(ANL, IND, LBL+)	REFID=22868
BAILEY	83	PL 132B 230	R. Bailey <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)	REFID=22870
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)	REFID=22866
YELTON	82	PRL 49 430	J.M. Yelton <i>et al.</i>	(SLAC, LBL, UCB+)	REFID=22867
FITCH	81	PRL 46 761	V.L. Fitch <i>et al.</i>	(PRIN, SACL, TORI+)	REFID=22863
AVERY	80	PRL 44 1309	P. Avery <i>et al.</i>	(ILL, FNAL, COLU)	REFID=11498
BLIETSCHAU	79	PL 86B 108	J. Blietschau <i>et al.</i>	(AACH3, BONN, CERN+)	REFID=22861
FELDMAN	77B	PRL 38 1313	G.J. Feldman <i>et al.</i>	(Mark I Collab.)	REFID=22858
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)	REFID=11434
PERUZZI	77	PRL 39 1301	I. Peruzzi <i>et al.</i>	(LGW Collab.)	REFID=11435

NODE=M252

D₀^{*}(2300)

$$I(J^P) = \frac{1}{2}(0^+)$$

was D₀^{*}(2400)

There is a strong evidence that recent data on $B \rightarrow D\pi\pi$ (AAIJ 15Y, AAIJ 16AH) and $B \rightarrow D\pi K$ (AAIJ 14BH, AAIJ 15V, AAIJ 15X) call for two poles in the scalar $I = 1/2 \pi D$ amplitude in this mass range. The data are consistent with a lower pole at $(2105_{-8}^{+6}) - i(102_{-11}^{+10})$ MeV and a higher pole at $(2451_{-26}^{+35}) - i(134_{-8}^{+7})$ MeV (DU 18A, DU 19, DU 21). For details see review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M252

D₀^{*}(2300) MASS

NODE=M252M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2343 ± 10 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.					
2360 ± 15 ± 30		1 AAIJ	15X	LHCB	+ B ⁰ → D ⁰ K ⁺ π ⁻
2349 ± 6 ± 4		2 AAIJ	15Y	LHCB	+ B ⁰ → D ⁰ π ⁺ π ⁻
2297 ± 8 ± 20	3.4k	AUBERT	09AB	BABR	0 B ⁻ → D ⁺ π ⁻ π ⁻
2308 ± 17 ± 32		ABE	04D	BELL	0 B ⁻ → D ⁺ π ⁻ π ⁻
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2354 ± 7 ± 11		3 AAIJ	15Y	LHCB	+ B ⁰ → D ⁰ π ⁺ π ⁻
2403 ± 14 ± 35	18.8k	4 LINK	04A	FOCS	+ γ A
2407 ± 21 ± 35	9.8k	4 LINK	04A	FOCS	0 γ A

NODE=M252M

OCCUR=2

OCCUR=2

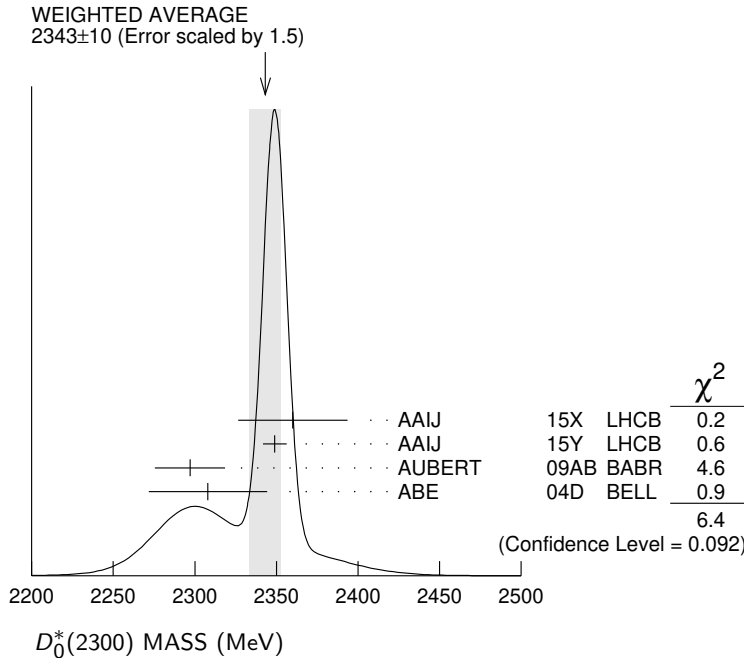
- ¹ From the Dalitz plot analysis including various K* and D** mesons as well as broad structures in the Kπ S-wave and the Dπ S- and P-waves.
- ² Modeling the π⁺π⁻ S-wave with the Isobar formalism.
- ³ Modeling the π⁺π⁻ S-wave with the K-matrix formalism.
- ⁴ Possibly the feed-down from another state.

NODE=M252M;LINKAGE=A

NODE=M252M;LINKAGE=B

NODE=M252M;LINKAGE=C

NODE=M252M;LINKAGE=D



D₀^{*}(2300) WIDTH

NODE=M252W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
229 ± 16 OUR AVERAGE					
255 ± 26 ± 51		1 AAIJ	15X	LHCB	+ B ⁰ → D ⁰ K ⁺ π ⁻
217 ± 13 ± 13		2 AAIJ	15Y	LHCB	+ B ⁰ → D ⁰ π ⁺ π ⁻
273 ± 12 ± 48	3.4k	AUBERT	09AB	BABR	0 B ⁻ → D ⁺ π ⁻ π ⁻
276 ± 21 ± 63		ABE	04D	BELL	0 B ⁻ → D ⁺ π ⁻ π ⁻

NODE=M252W

• • • We do not use the following data for averages, fits, limits, etc. • • •

230±15±21		³ AAIJ	15Y LHCB +	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
283±24±34	18.8k	⁴ LINK	04A FOCS +	γA
240±55±59	9.8k	⁴ LINK	04A FOCS 0	γA

OCCUR=2

OCCUR=2

NODE=M252W;LINKAGE=A

NODE=M252W;LINKAGE=B

NODE=M252W;LINKAGE=C

NODE=M252W;LINKAGE=D

- ¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.
- ² Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.
- ³ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.
- ⁴ Possibly the feed-down from another state.

$D_0^*(2300)$ DECAY MODES

NODE=M252215;NODE=M252

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 D\pi^\pm$	seen

DESIG=1

$D_0^*(2300)$ BRANCHING RATIOS

NODE=M252225

$\Gamma(D\pi^\pm)/\Gamma_{total}$		DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
seen		AAIJ	15X LHCB +		$D^*(2300)^+ \rightarrow D^0 \pi^+$	
seen		AAIJ	15Y LHCB +		$D^*(2300)^+ \rightarrow D^0 \pi^+$	
seen	3.4k	AUBERT	09AB BABR 0		$D^*(2300)^0 \rightarrow D^+ \pi^-$	
seen		ABE	04D BELL 0		$D^*(2300)^0 \rightarrow D^+ \pi^-$	
seen	18.8k	LINK	04A FOCS +		$D^*(2300)^+ \rightarrow D^0 \pi^+$	

NODE=M252R01
NODE=M252R01

$D_0^*(2300)$ REFERENCES

NODE=M252

DU	21	PRL 126 192001	M.-L. Du <i>et al.</i>			REFID=61096
DU	19	PR D99 114002	M.-L. Du, F.-K. Guo, U.-G. Meissner			REFID=59893
DU	18A	PR D98 094018	M.-L. Du <i>et al.</i>			REFID=61424
AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=57518
AAIJ	15V	PR D91 092002	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=56575
Also		PR D93 119901 (errat.)	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=57289
AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=56588
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=56609
AAIJ	14BH	PR D90 072003	R. Aaij <i>et al.</i>		(LHCb Collab.)	REFID=56208
AUBERT	09AB	PR D79 112004	B. Aubert <i>et al.</i>		(BABAR Collab.)	REFID=52941
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>		(BELLE Collab.)	REFID=50011
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>		(FOCUS Collab.)	REFID=49775

NODE=M253

$D_1(2420)$

$$I(J^P) = \frac{1}{2}(1^+)$$

$D_1(2420)$ MASS

NODE=M253M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M253M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2422.1±0.6 OUR FIT		Error includes scale factor of 1.7.			
2422.1±0.8 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.			
2424.8±0.1±0.7	79k	¹ AAIJ	20D LHCB 0		$B^- \rightarrow D^{*+} \pi^- \pi^-$
2427.2±1.0±1.2	4207	ABLIKIM	20P BES3 +		$e^+ e^- \rightarrow D^+ D^- \pi^+ \pi^-$
2419.6±0.1±0.7	210k	AAIJ	13CC LHCB 0		$p p \rightarrow D^{*+} \pi^- X$
2423.1±1.5 ^{+0.4} _{-1.0}	2.7k	² ABRAMOWICZ13	ZEUS 0		$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2421.9±4.7 ^{+3.4} _{-1.2}	759	³ ABRAMOWICZ13	ZEUS +		$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2420.1±0.1±0.8	103k	DEL-AMO-SA..10P	BABR 0		$e^+ e^- \rightarrow D^{*+} \pi^- X$
2426 ±3 ±1	151	ABE	05A BELL 0		$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
2421 ±2 ±1	124	ABE	05A BELL +		$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
2421.4±1.5±0.9		⁴ ABE	04D BELL 0		$B^- \rightarrow D^{*+} \pi^- \pi^-$
2421 ⁺¹ ₋₂ ±2	286	AVERY	94C CLE2 0		$e^+ e^- \rightarrow D^{*+} \pi^- X$
2425 ±2 ±2	146	BERGFELD	94B CLE2 +		$e^+ e^- \rightarrow D^{*0} \pi^+ X$
2422 ±2 ±2	51	FRABETTI	94B E687 0		$\gamma Be \rightarrow D^{*+} \pi^- X$
2428 ±3 ±2	279	AVERY	90 CLEO 0		$e^+ e^- \rightarrow D^{*+} \pi^- X$
2414 ±2 ±5	171	ALBRECHT	89H ARG 0		$e^+ e^- \rightarrow D^{*+} \pi^- X$
2428 ±8 ±5	171	ANJOS	89C TPS +		$\gamma N \rightarrow D^{*+} \pi^- X$
2443 ±7 ±5	190	ANJOS	89C TPS +		$\gamma N \rightarrow D^0 \pi^+ X^0$

NODE=M253M

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

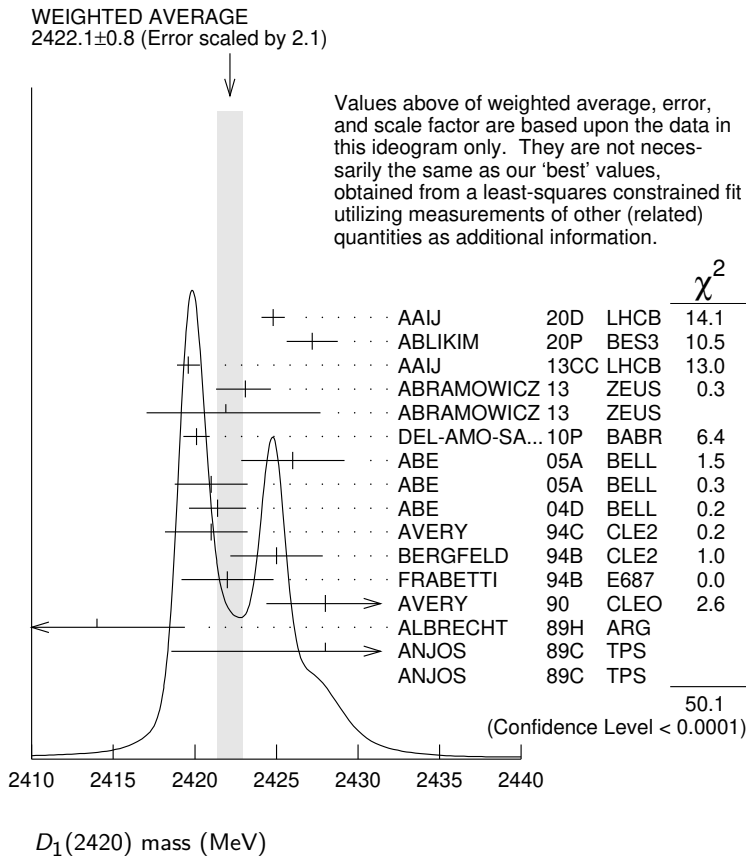
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

2420.5±2.1±0.9	3.1k	⁵ CHEKANOV	09	ZEUS	0	$e^\pm p \rightarrow D^{*+} \pi^- X$
2421.7±0.7±0.6	7.5k	ABULENCIA	06A	CDF	0	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$
2425 ±3	235	⁶ ABREU	98M	DLPH	0	$e^+ e^-$

- ¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.
- ² From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .
- ³ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^+ are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.
- ⁴ Fit includes the contribution from $D_1^*(2430)^0$.
- ⁵ Calculated using the mass difference $m(D_1^0) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of 0.9 MeV.
- ⁶ No systematic error given.

NODE=M253M;LINKAGE=B
 NODE=M253M;LINKAGE=AR
 NODE=M253M;LINKAGE=BA
 NODE=M253M;LINKAGE=AB
 NODE=M253M;LINKAGE=CH
 NODE=M253M;LINKAGE=K



$m_{D_1(2420)^0} - m_{D^{*+}}$ NODE=M253DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$
 and $D_{s1}(2536)^\pm$ mass and mass difference measurements. NODE=M253DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	NODE=M253DM
411.8±0.6 OUR FIT		Error includes scale factor of 1.7.			
411.5±0.8 OUR AVERAGE					
410.2±2.1±0.9	3.1k	CHEKANOV	09	ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA	06A	CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$

$m_{D_1(2420)^\pm} - m_{D_1(2420)^0}$ NODE=M253DMC

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	NODE=M253DMC
$4^+_{-3} \pm 3$	BERGFELD	94B	CLE2	$e^+ e^- \rightarrow$ hadrons

D₁(2420) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
31.3 ± 1.9 OUR AVERAGE		Error includes scale factor of 2.8. See the ideogram below.				
33.6 ± 0.3 ± 2.7	79k	¹ AAIJ	20D	LHCB	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
23.2 ± 2.3 ± 2.3	4207	ABLIKIM	20P	BES3	+	$e^+ e^- \rightarrow D^+ D^- \pi^+ \pi^-$
35.2 ± 0.4 ± 0.9	210k	AAIJ	13CC	LHCB	0	$pp \rightarrow D^{*+} \pi^- X$
38.8 ± 5.0 ⁺ _{5.4}	2.7k	² ABRAMOWICZ13	ZEUS	0	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
31.4 ± 0.5 ± 1.3	103k	DEL-AMO-SA...10P	BABR	0	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
20.0 ± 1.7 ± 1.3	7.5k	ABULENCIA	06A	CDF	0	$1900 p\bar{p} \rightarrow D^{*+} \pi^- X$
24 ± 7 ± 8	151	ABE	05A	BELL	0	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
21 ± 5 ± 8	124	ABE	05A	BELL	+	$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
23.7 ± 2.7 ± 4.0		³ ABE	04D	BELL	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
20 ⁺ ₅ ± 6 ± 3	286	AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
26 ⁺ ₇ ± 8 ± 4	146	BERGFELD	94B	CLE2	+	$e^+ e^- \rightarrow D^{*0} \pi^+ X$
15 ± 8 ± 4	51	FRABETTI	94B	E687	0	$\gamma Be \rightarrow D^{*+} \pi^- X$
23 ⁺ ₆ ± 8 ± 10 ₃	279	AVERY	90	CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
13 ± 6 ± 10 ₅	171	ALBRECHT	89H	ARG	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
41 ± 19 ± 8	190	ANJOS	89C	TPS	+	$\gamma N \rightarrow D^0 \pi^+ X^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
53.2 ± 7.2 ⁺ _{4.9}	3.1k	CHEKANOV	09	ZEUS	0	$e^\pm p \rightarrow D^{*+} \pi^- X$
58 ± 14 ± 10	171	ANJOS	89C	TPS	0	$\gamma N \rightarrow D^{*+} \pi^- X$

NODE=M253W

NODE=M253W

OCCUR=2

OCCUR=2

OCCUR=2

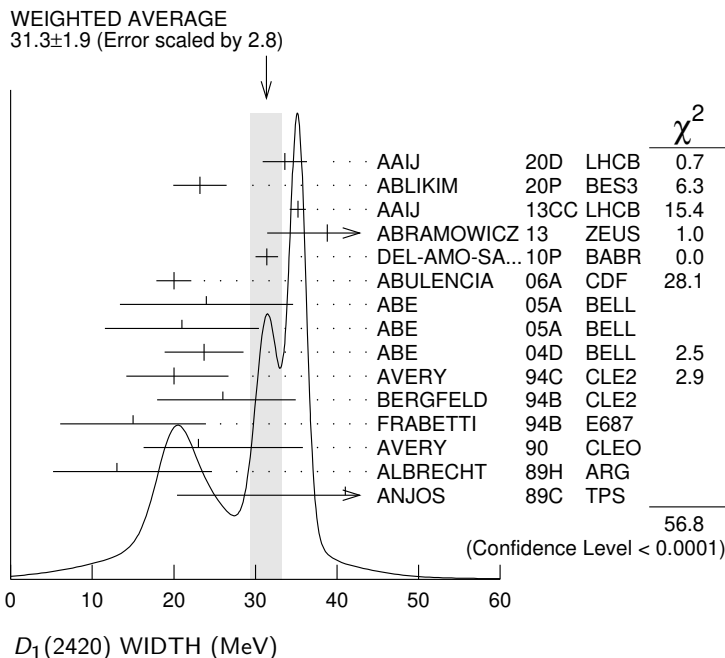
OCCUR=2

NODE=M253W;LINKAGE=B

NODE=M253W;LINKAGE=AR

NODE=M253W;LINKAGE=AB

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.
² From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1.
³ Fit includes the contribution from $D_1^*(2430)^0$.



D₁(2420) DECAY MODES

NODE=M253215;NODE=M253

$\bar{D}_1(2420)$ modes are charge conjugates of modes below.

NODE=M253

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2007)^0 \pi$	seen
Γ_2 $D \pi^+ \pi^-$	
Γ_3 $D \rho^0$	

DESIG=1

DESIG=3

DESIG=4

Γ_4	$D f_0(500)$
Γ_5	$D_0^*(2300)^0 \pi$
Γ_6	$D^0 \pi$
Γ_7	$D^* \pi^+ \pi^-$

DESIG=5
DESIG=6
DESIG=2
DESIG=7

$D_1(2420)$ BRANCHING RATIOS

NODE=M253220

$\Gamma(D^*(2007)^0 \pi) / \Gamma_{\text{total}}$

Γ_1 / Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	ACKERSTAFF 97W	OPAL	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
seen	AVERY 90	CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
seen	ALBRECHT 89H	ARG	0	$e^+ e^- \rightarrow D^* \pi^- X$
seen	ANJOS 89C	TPS	0	$\gamma N \rightarrow D^{*+} \pi^- X$
seen	ANJOS 89C	TPS	+	$\gamma N \rightarrow D^0 \pi^+ X^0$

NODE=M253R01
NODE=M253R01

OCCUR=2

$\Gamma(D^0 \pi) / \Gamma(D^*(2007)^0 \pi)$

Γ_6 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.18	90	BERGFELD 94B	CLE2	+	$e^+ e^- \rightarrow \text{hadrons}$
•••					We do not use the following data for averages, fits, limits, etc. •••
<0.24	90	AVERY 90	CLEO	0	$e^+ e^- \rightarrow D^+ \pi^- X$

NODE=M253R02
NODE=M253R02

OCCUR=2

$D_1(2420)$ POLARIZATION AMPLITUDE A_{D_1}

NODE=M253PAH

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^* \pi$ and the $D^* \rightarrow D \pi$.

NODE=M253PAH

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
5.73 ± 0.25 OUR AVERAGE						
7.8 ^{+6.7} _{-2.7} ^{+4.6} _{-1.8}	2.7k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$	
5.72 ± 0.25	103k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
5.9 ^{+3.0} _{-1.7} ^{+2.4} _{-1.0}		CHEKANOV 09	ZEUS	0	$e^\pm p \rightarrow D^{*+} \pi^- X$	
•••					We do not use the following data for averages, fits, limits, etc. •••	
3.30 ± 0.48	210k	² AAIJ	13CC	LHCB	0	$pp \rightarrow D^{*+} \pi^- X$
3.8 ± 0.6 ± 0.8		³ AUBERT	09Y	BABR	0	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
3.8 ± 0.6 ± 0.8		³ AUBERT	09Y	BABR	+	$B^0 \rightarrow D_1^- \ell^+ \nu_\ell$
2.74 ^{+1.40} _{-0.93}		⁴ AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M253PAH

OCCUR=2

¹ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 . A pure D -wave not excluded although some S -wave mixing possible.

NODE=M253PAH;LINKAGE=AR

² Systematic uncertainty not estimated. Resonance parameters fixed.

NODE=M253PAH;LINKAGE=A

³ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+ B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0 \bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

NODE=M253PAH;LINKAGE=AU

⁴ Systematic uncertainties not estimated.

NODE=M253PAH;LINKAGE=AV

$D_1(2420)$ REFERENCES

NODE=M253

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60253
ABLIKIM	20P	PL B804 135395	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60395
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55581
ABRAMOWICZ	13	NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54743
DEL-AMO-SA...	10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52929
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
ABULENCIA	06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)	REFID=51054
ABE	05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50755
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50011
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46315
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)	REFID=44096
BERGFELD	94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)	REFID=44099
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41001
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)	REFID=40737

$D_1(2430)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

 $J^P = 1^+$ determined by AAIJ 20D.

NODE=M180

NODE=M180

NODE=M180M

NODE=M180M

 $D_1(2430)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2412 ± 9 OUR AVERAGE				
2411 ± 3 ± 9	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2427 ± 26 ± 25		ABE	04D BELLE	$B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2477 ± 28		² AUBERT	06L BABR	$\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² Systematic errors not estimated.NODE=M180M;LINKAGE=A
NODE=M180M;LINKAGE=AU **$D_1(2430)^0$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
314 ± 29 OUR AVERAGE				
309 ± 9 ± 28	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
384 ⁺¹⁰⁷ ₋₇₅ ± 74		ABE	04D BELLE	$B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
266 ± 97		² AUBERT	06L BABR	$\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² Systematic errors not estimated.

NODE=M180W

NODE=M180W

NODE=M180W;LINKAGE=A
NODE=M180W;LINKAGE=AU **$D_1(2430)^0$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2010)^+ \pi^-$	seen

NODE=M180215;NODE=M180

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D_1(2430)^0$ REFERENCES

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AUBERT	06L	PR D74 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M180

REFID=60253
REFID=51140
REFID=50011

$D_2^*(2460)$

$$I(J^P) = \frac{1}{2}(2^+)$$

NODE=M254

 $D_2^*(2460)$ MASS

NODE=M254M

The fit includes D^\pm , D^0 , D_s^\pm , $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2461.1±0.8 OUR FIT		Error includes scale factor of 6.3.			
2461.1±0.7 OUR AVERAGE		Error includes scale factor of 5.2. See the ideogram below.			
2463.7±0.4±0.7	28k	1 AAIJ	16AH LHCB	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.0±1.4±0.5	2k	2 AAIJ	15V LHCB	0	$B^- \rightarrow D^+ K^- \pi^-$
2465.6±1.8±1.3		3 AAIJ	15X LHCB	+	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2468.6±0.6±0.3		4 AAIJ	15Y LHCB	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2460.4±0.4±1.2	82k	AAIJ	13CC LHCB	0	$pp \rightarrow D^{*+} \pi^- X$
2460.4±0.1±0.1	675k	AAIJ	13CC LHCB	0	$pp \rightarrow D^+ \pi^- X$
2463.1±0.2±0.6	342k	AAIJ	13CC LHCB	+	$pp \rightarrow D^0 \pi^+ X$
2462.5±2.4 ^{+1.3} _{-1.1}	2.3k	5 ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2460.6±4.4 ^{+3.6} _{-0.8}	1371	6 ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2462.2±0.1±0.8	243k	DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2465.4±0.2±1.1	111k	7 DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2460.4±1.2±2.2	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	+	$e^+ e^- \rightarrow \text{hadrons}$
2461.6±2.1±3.3		8 ABE	04D BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5±1.1±1.9	5.8k	8 LINK	04A FOCS	0	γA
2465 ±3 ±3	486	AVERY	94C CLE2	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2463 ±3 ±3	310	BERGFELD	94B CLE2	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	128	FRABETTI	94B E687	0	$\gamma \text{Be} \rightarrow D^+ \pi^- X$
2453 ±3 ±2	185	FRABETTI	94B E687	+	$\gamma \text{Be} \rightarrow D^0 \pi^+ X$
2461 ±3 ±1	440	AVERY	90 CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 ±3 ±5	337	ALBRECHT	89B ARG	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2469 ±4 ±6		ALBRECHT	89F ARG	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2459 ±3 ±2	153	ANJOS	89C TPS	0	$\gamma N \rightarrow D^+ \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2468.1±0.6±0.5		9 AAIJ	15Y LHCB	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2469.1±3.7 ^{+1.2} _{-1.3}	1.5k	10 CHEKANOV	09 ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2463.3±0.6±0.8	20k	ABULENCIA	06A CDF	0	$1900 p\bar{p} \rightarrow D^+ \pi^- X$
2467.6±1.5±0.8	3.5k	11 LINK	04A FOCS	+	γA
2461 ±6	126	12 ABREU	98M DLPH	0	$e^+ e^-$
2466 ±7	1	ASRATYAN	95 BEBC	0	$53,40 \nu(\bar{\nu}) \rightarrow pX, dX$

NODE=M254M

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M254M;LINKAGE=B

NODE=M254M;LINKAGE=A

NODE=M254M;LINKAGE=CA

NODE=M254M;LINKAGE=BC

NODE=M254M;LINKAGE=AR

NODE=M254M;LINKAGE=AB

NODE=M254M;LINKAGE=DE

NODE=M254M;LINKAGE=LI

NODE=M254M;LINKAGE=CC

NODE=M254M;LINKAGE=CH

¹ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S -wave and the $D\pi$ S - and P -waves.

⁴ Modeling the $\pi^+ \pi^-$ S -wave with the Isobar formalism.

⁵ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

⁶ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.

⁷ At a fixed width of 50.5 MeV.

⁸ Fit includes the contribution from $D_0^*(2400)^0$.

⁹ Modeling the $\pi^+ \pi^-$ S -wave with the K-matrix formalism.

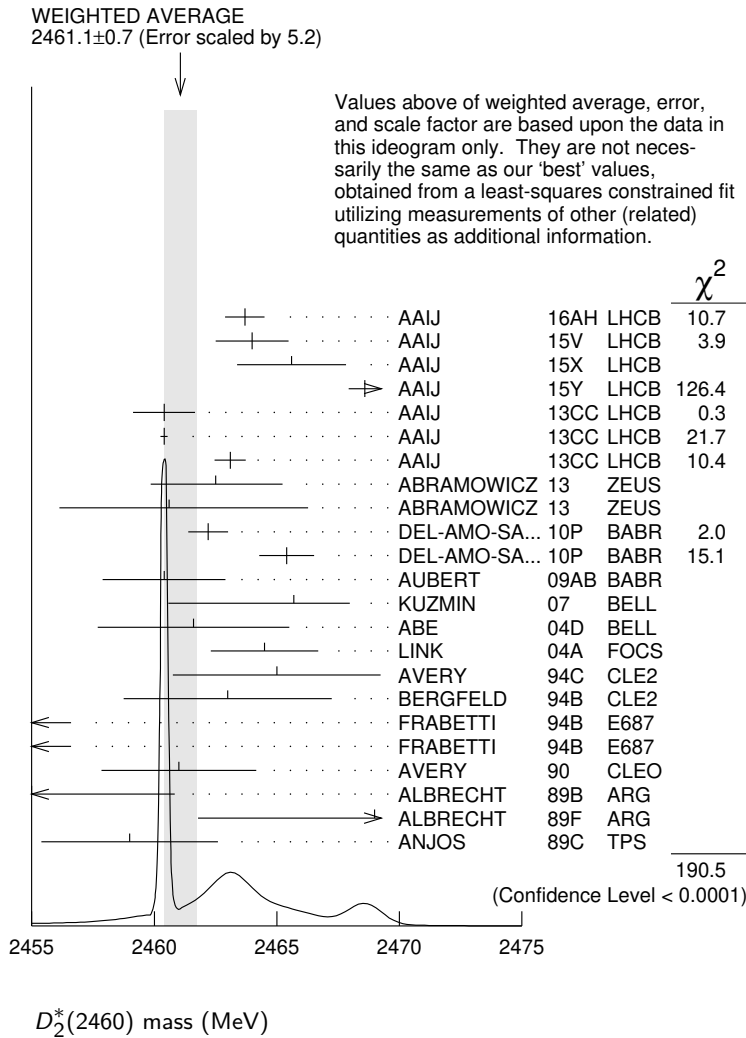
¹⁰ Calculated using the mass difference $m(D_2^{*0}) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of $^{+1.2}_{-1.3}$ MeV.

¹¹ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm}) - (m_{D_2^*(2460)^0})$.

NODE=M254M;LINKAGE=LC

¹² No systematic error given.

NODE=M254M;LINKAGE=K



$$m_{D_2^*(2460)^0} - m_{D^+}$$

NODE=M254DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$ and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
591.5±0.8 OUR FIT				Error includes scale factor of 6.0.
593.9±0.6±0.5	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$

NODE=M254DM

$$m_{D_2^*(2460)^0} = m_{D^{*++}}$$

NODE=M254DM2

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0,$ and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
450.9±0.8 OUR FIT				Error includes scale factor of 6.0.
458.8±3.7^{+1.2}_{-1.3}	1.5k	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$

NODE=M254DM2

$$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$$

NODE=M254DMC

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4±1.7 OUR AVERAGE			
3.1±1.9±0.9	LINK	04A FOCS	γA
- 2 ±4 ±4	BERGFELD	94B CLE2	$e^+e^- \rightarrow \text{hadrons}$
0 ±4	FRABETTI	94B E687	$\gamma Be \rightarrow D\pi X$
14 ±5 ±8	ALBRECHT	89F ARG	$e^+e^- \rightarrow D^0\pi^+X$

NODE=M254DMC

 $D_2^*(2460)$ WIDTH

NODE=M254W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
47.3± 0.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
47.0± 0.8± 1.0	28k	¹ AAIJ	16AH LHCb	0	$B^- \rightarrow D^+\pi^-\pi^-$
43.8± 2.9± 1.8	2k	² AAIJ	15V LHCb	0	$B^- \rightarrow D^+K^-\pi^-$
46.0± 3.4± 3.2		³ AAIJ	15X LHCb	+	$B^0 \rightarrow \bar{D}^0K^+\pi^-$
47.3± 1.5± 0.7		⁴ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$
43.2± 1.2± 3.0	82k	AAIJ	13CC LHCb	0	$p p \rightarrow D^{*+}\pi^-X$
45.6± 0.4± 1.1	675k	AAIJ	13CC LHCb	0	$p p \rightarrow D^+\pi^-X$
48.6± 1.3± 1.9	342k	AAIJ	13CC LHCb	+	$p p \rightarrow D^0\pi^+X$
46.6± 8.1 ⁺ ₋ 5.9 _{3.8}	2.3k	⁵ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$
50.5± 0.6± 0.7	243k	DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
41.8± 2.5± 2.9	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+\pi^-\pi^-$
49.7± 3.8± 6.4	2909	KUZMIN	07 BELL	+	$e^+e^- \rightarrow \text{hadrons}$
49.2± 2.3± 1.3	20k	ABULENCIA	06A CDF	0	1900 $p\bar{p} \rightarrow D^+\pi^-X$
45.6± 4.4± 6.7		⁶ ABE	04D BELL	0	$B^- \rightarrow D^+\pi^-\pi^-$
38.7± 5.3± 2.9	5.8k	⁶ LINK	04A FOCS	0	γA
34.1± 6.5± 4.2	3.5k	⁷ LINK	04A FOCS	+	γA
28 ⁺ ₋ 8 ₇ ± 6	486	AVERY	94C CLE2	0	$e^+e^- \rightarrow D^+\pi^-X$
27 ⁺ ₋ 11 ₈ ± 5	310	BERGFELD	94B CLE2	+	$e^+e^- \rightarrow D^0\pi^+X$
25 ±10 ± 5	128	FRABETTI	94B E687	0	$\gamma Be \rightarrow D^+\pi^-X$
23 ± 9 ± 5	185	FRABETTI	94B E687	+	$\gamma Be \rightarrow D^0\pi^+X$
20 ⁺ ₋ 9 ₋₁₂ ⁺ ₋ 9 ₋₁₀	440	AVERY	90 CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
15 ⁺ ₋ 13 ₋₁₀ ⁺ ₋ 5 ₋₁₀	337	ALBRECHT	89B ARG	0	$e^+e^- \rightarrow D^+\pi^-X$
20 ±10 ± 5	153	ANJOS	89C TPS	0	$\gamma N \rightarrow D^+\pi^-X$

NODE=M254W

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

46.0± 1.4± 1.8		⁸ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$
¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.					
² From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.					
³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.					
⁴ Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.					
⁵ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1.					
⁶ Fit includes the contribution from $D_0^*(2400)^0$.					
⁷ Fit includes the contribution from $D_0^*(2400)^\pm$.					
⁸ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.					

NODE=M254W;LINKAGE=D

NODE=M254W;LINKAGE=A

NODE=M254W;LINKAGE=AC

NODE=M254W;LINKAGE=B

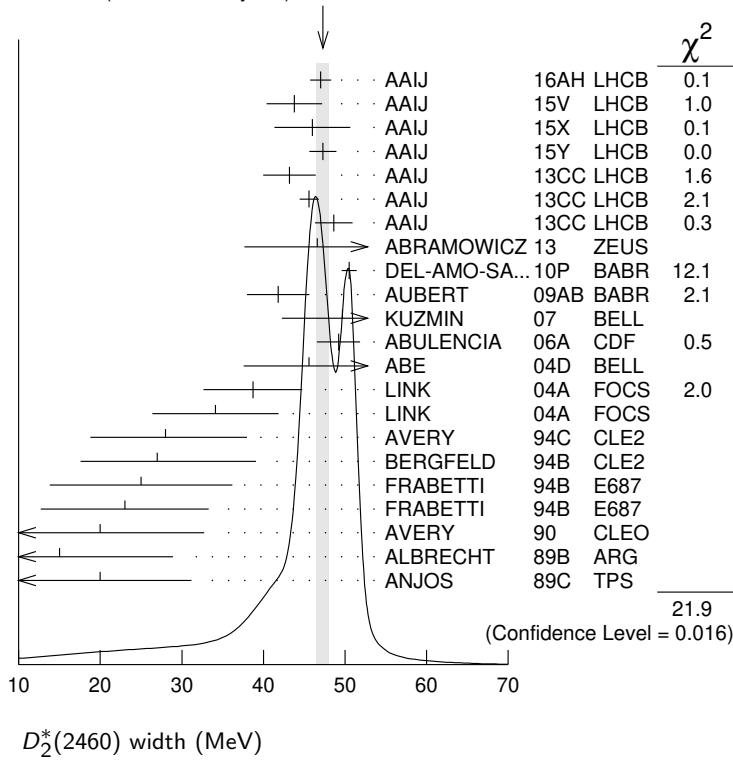
NODE=M254W;LINKAGE=AR

NODE=M254W;LINKAGE=LI

NODE=M254W;LINKAGE=LC

NODE=M254W;LINKAGE=C

WEIGHTED AVERAGE
47.3±0.8 (Error scaled by 1.5)



D₂^{*}(2460) DECAY MODES

NODE=M254215;NODE=M254

$\bar{D}_2^*(2460)$ modes are charge conjugates of modes below.

NODE=M254

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi^-$	seen
Γ_2 $D^*(2010)\pi^-$	seen
Γ_3 $D\pi^+\pi^-$	
Γ_4 $D^*\pi^+\pi^-$	

DESIG=1
DESIG=2
DESIG=3
DESIG=4

D₂^{*}(2460) BRANCHING RATIOS

NODE=M254220

$\Gamma(D\pi^-)/\Gamma_{total}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	3.4k	AUBERT 09AB BABR	0		$B^- \rightarrow D^+\pi^-\pi^-$	
seen	337	ALBRECHT 89B ARG	0		$e^+e^- \rightarrow D^+\pi^-X$	
seen		ALBRECHT 89F ARG	+		$e^+e^- \rightarrow D^0\pi^+X$	
seen		ANJOS 89C TPS	0		$\gamma N \rightarrow D^+\pi^-X$	

NODE=M254R1
NODE=M254R1

$\Gamma(D^*(2010)\pi^-)/\Gamma_{total}$						Γ_2/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
seen	ACKERSTAFF 97W OPAL	0		$e^+e^- \rightarrow D^{*+}\pi^-X$		
seen	AVERY 90 CLEO	0		$e^+e^- \rightarrow D^{*+}\pi^-X$		
seen	ALBRECHT 89H ARG	0		$e^+e^- \rightarrow D^*\pi^-X$		

NODE=M254R2
NODE=M254R2

$\Gamma(D\pi^-)/\Gamma(D^*(2010)\pi^-)$						Γ_1/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1.52±0.14 OUR AVERAGE						
1.4 ±0.3 ±0.3	2.3k	1 ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$	
1.1 ±0.4 $\begin{smallmatrix} +0.3 \\ -0.2 \end{smallmatrix}$	1371	2 ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0}\pi^+X$	OCCUR=2
1.47±0.03±0.16	379k	DEL-AMO-SA...10P	BABR	0	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	
2.8 ±0.8 $\begin{smallmatrix} +0.5 \\ -0.6 \end{smallmatrix}$	1.5k	CHEKANOV 09	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$	
2.2 ±0.7 ±0.6		AVERY 94C	CLE2	0	$e^+e^- \rightarrow D^{*+}\pi^-X$	

NODE=M254R3
NODE=M254R3

1.9 ±1.1 ±0.3	BERGFELD	94B	CLE2	+	$e^+e^- \rightarrow \text{hadrons}$	OCCUR=2
2.3 ±0.8	AVERY	90	CLEO	0	e^+e^-	
3.0 ±1.1 ±1.5	ALBRECHT	89H	ARG	0	$e^+e^- \rightarrow D^*\pi^-X$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.9 ±0.5	ABE	04D	BELL	0	$B^- \rightarrow D^{(*)+}\pi^-\pi^-$	
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¹ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

² From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.

NODE=M254R3;LINKAGE=AR

NODE=M254R3;LINKAGE=AB

$\Gamma(D\pi^-)/[\Gamma(D\pi^-) + \Gamma(D^*(2010)\pi^-)]$ $\Gamma_1/(\Gamma_1+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M254R01
NODE=M254R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.62±0.03±0.02	8414	¹ AUBERT	09Y	BABR	0	$B^+ \rightarrow D_2^{*0}\ell^+\nu_\ell$	
0.62±0.03±0.02	3361	¹ AUBERT	09Y	BABR	+	$\bar{B}^0 \rightarrow D_2^{*+}\ell^-\nu_\ell$	OCCUR=2

OCCUR=2

¹ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.

NODE=M254R01;LINKAGE=AU

$D_2^*(2460)$ POLARIZATION AMPLITUDE A_{D_2}

NODE=M254PAM

A polarization amplitude A_{D_2} is a parameter that depends on the initial polarization of the D_2 . For D_2 decays the helicity angle, θ_H , distribution varies like $1 + A_{D_2} \cos^2(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_2 \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$.

NODE=M254PAM

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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NODE=M254PAM

• • • We do not use the following data for averages, fits, limits, etc. • • •

-1.16 ± 0.35	2.3k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$		
consistent with -1	243k	DEL-AMO-SA...10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$		
$-0.74^{+0.49}_{-0.38}$		² AVERY	94C	CLE2	0	$e^+e^- \rightarrow D^{*+}\pi^-X$	

¹ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions.

² Systematic uncertainties not estimated.

NODE=M254PAM;LINKAGE=AB
NODE=M254PAM;LINKAGE=AV

$D_2^*(2460)$ REFERENCES

NODE=M254

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57518
AAIJ	15V	PR D91 092002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56575
Also		PR D93 119901 (errat.)	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57289
AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56588
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56609
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55581
ABRAMOWICZ 13	NP	B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54743
DEL-AMO-SA...10P	PR	D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534
AUBERT	09AB	PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52941
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52929
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
KUZMIN	07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)	REFID=51854
ABULENCIA	06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)	REFID=51054
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50011
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)	REFID=49775
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46315
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=44439
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)	REFID=44096
BERGFELD	94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)	REFID=44099
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=40736
ALBRECHT	89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40931
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=41001
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)	REFID=40737

$D_0(2550)^0$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE
 $J^P = 0^-$ determined by AAIJ 20D.

NODE=M198

NODE=M198

NODE=M198M

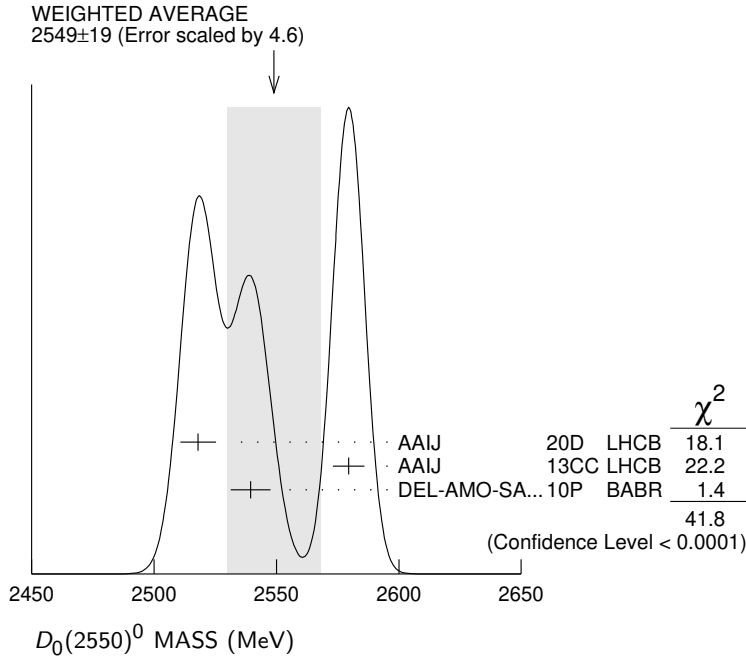
NODE=M198M

NODE=M198M;LINKAGE=A

$D_0(2550)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2549 ±19 OUR AVERAGE		Error includes scale factor of 4.6. See the ideogram below.		
2518 ± 2 ±7	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2579.5 ± 3.4 ±5.5	60k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
2539.4 ± 4.5 ±6.8	34k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.



$D_0(2550)^0$ WIDTH

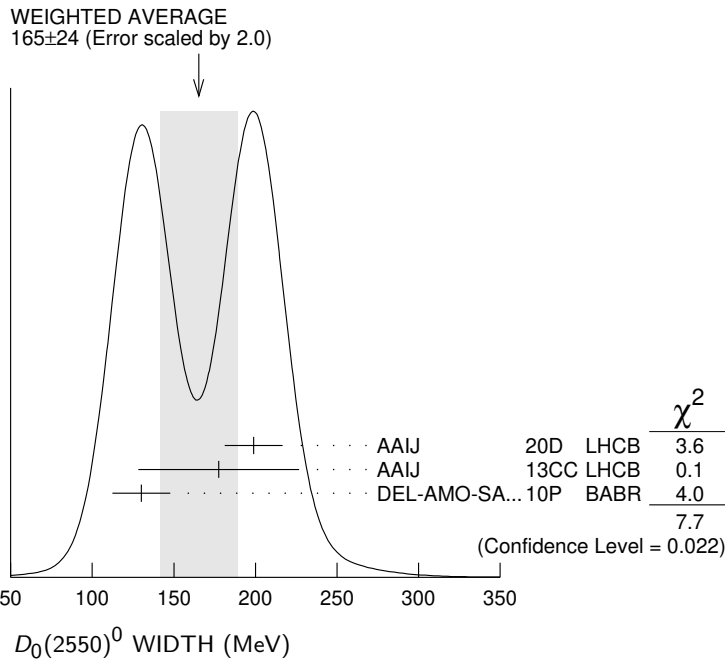
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
165 ±24 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
199 ± 5 ±17	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
177.5 ±17.8 ±46.0	60k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
130 ±12 ±13	34k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M198W

NODE=M198W

NODE=M198W;LINKAGE=A



$D_0(2550)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+} \pi^-$	seen

NODE=M198215;NODE=M198

DESIG=1;OUR EVAL;→ UNCHECKED ←

$D_0(2550)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

NODE=M198PAM

NODE=M198PAM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M198PAM

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●
4.2±1.3 60k ¹ AAIJ 13CC LHCB $pp \rightarrow D^{*+} \pi^- X$

¹Systematic uncertainty not estimated.

NODE=M198PAM;LINKAGE=A

$D_0(2550)^0$ REFERENCES

NODE=M198

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...	10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

REFID=60253
REFID=55581
REFID=53534

$D_1^*(2600)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

OMITTED FROM SUMMARY TABLE

was $D_j^*(2600)$ $J^P = 1^-$ determined by AAIJ 20D.

NODE=M199

NODE=M199

NODE=M199M

NODE=M199M

 $D_1^*(2600)^0$ MASS

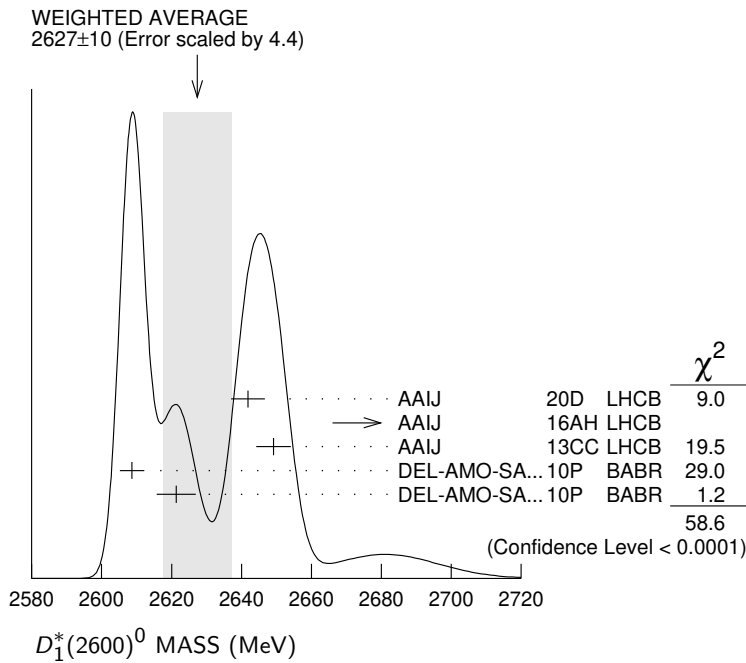
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2627 ±10	OUR AVERAGE	Error includes scale factor of 4.4. See the ideogram below.			
2641.9 ± 1.8 ± 4.5	79k	¹ AAIJ	20D	LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2681.1 ± 5.6 ± 14.0	28k	² AAIJ	16AH	LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
2649.2 ± 3.5 ± 3.5	51k	AAIJ	13CC	LHCB	$pp \rightarrow D^{*+} \pi^- X$
2608.7 ± 2.4 ± 2.5	26k	DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2621.3 ± 3.7 ± 4.2	13k	³ DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

OCCUR=2

NODE=M199M;LINKAGE=B

NODE=M199M;LINKAGE=A

NODE=M199M;LINKAGE=DE

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.³ At a fixed width of 93 MeV. **$D_1^*(2600)^0$ WIDTH**

NODE=M199W

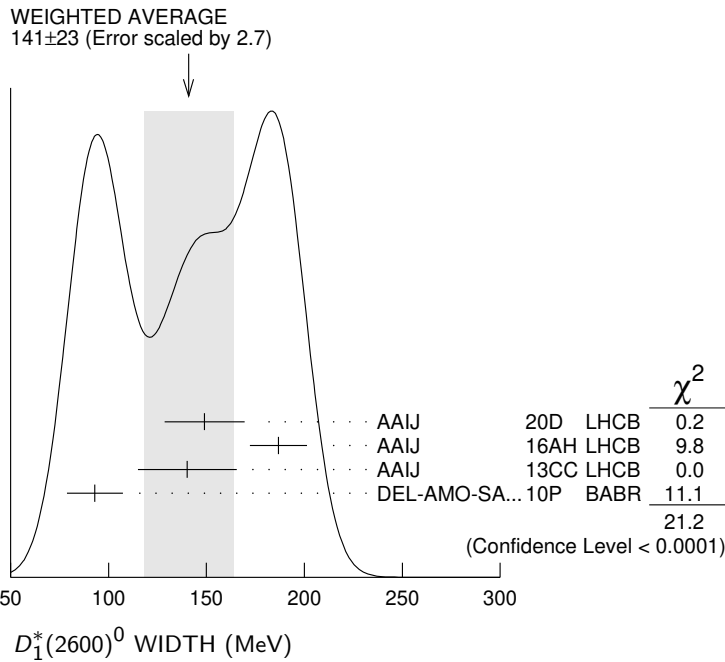
NODE=M199W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
141 ±23	OUR AVERAGE	Error includes scale factor of 2.7. See the ideogram below.		
149 ± 4 ± 20	79k	¹ AAIJ	20D	LHCB $B^- \rightarrow D^{*+} \pi^- \pi^-$
186.7 ± 8.5 ± 11.9	28k	² AAIJ	16AH	LHCB $B^- \rightarrow D^+ \pi^- \pi^-$
140.2 ± 17.1 ± 18.6	51k	AAIJ	13CC	LHCB $pp \rightarrow D^{*+} \pi^- X$
93 ± 6 ± 13	26k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

NODE=M199W;LINKAGE=B

NODE=M199W;LINKAGE=A



$D_1^*(2600)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi$	seen
Γ_2 $D^+\pi^-$	seen
Γ_3 $D^0\pi^\pm$	seen
Γ_4 $D^*\pi$	seen
Γ_5 $D^{*+}\pi^-$	seen

NODE=M199215;NODE=M199

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←

$D_1^*(2600)^0$ BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_5
	0.32±0.02±0.09	76k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	

NODE=M199220

NODE=M199R01
 NODE=M199R01

$D_1^*(2600)^0$ REFERENCES

AAIJ 20D PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ 16AH PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ 13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...10P PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M199

REFID=60253
 REFID=57518
 REFID=55581
 REFID=53534

$D^*(2640)^\pm$

$$I(J^P) = \frac{1}{2}(??)$$

OMITTED FROM SUMMARY TABLE

Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and CHEKANOV 09. Needs confirmation.

NODE=M158

NODE=M158

 $D^*(2640)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2637 ± 2 ± 6	66 ± 14	ABREU	98M DLPH	$e^+ e^- \rightarrow D^{*+} \pi^+ \pi^- X$

NODE=M158M

NODE=M158M

 $D^*(2640)^\pm$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+ e^- \rightarrow D^{*+} \pi^+ \pi^- X$

NODE=M158W

NODE=M158W

 $D^*(2640)^+$ DECAY MODES $D^*(2640)^-$ modes are charge conjugates of modes below.

NODE=M158215;NODE=M158

NODE=M158

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2010)^+ \pi^+ \pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

 $D^*(2640)^\pm$ REFERENCES

CHEKANOV 09 EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABBIENDI 01N EPJ C20 445	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU 98M PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)

NODE=M158

REFID=52733

REFID=48296

REFID=46315

NODE=M228

 $D_2(2740)^0$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE

was $D(2740)^0$ $J^P = 2^-$ determined by (AAIJ 20D).

NODE=M228

 $D_2(2740)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2747 ± 6 OUR AVERAGE				
2751 ± 3 ± 7	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2737.0 ± 3.5 ± 11.2	7.7k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$

NODE=M228M

NODE=M228M

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M228M;LINKAGE=A

 $D_2(2740)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
88 ± 19 OUR AVERAGE				
102 ± 6 ± 26	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
73.2 ± 13.4 ± 25.0	7.7k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$

NODE=M228W

NODE=M228W

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M228W;LINKAGE=A

$D_2(2740)^0$ DECAY MODES

NODE=M228215;NODE=M228

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+} \pi^-$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D_2(2740)^0$ POLARIZATION AMPLITUDE A_{D_J}

NODE=M228PAM

NODE=M228PAM

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M228PAM

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

3.1 ± 2.2	7.7k	¹ AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
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¹ Systematic uncertainty not estimated.

NODE=M228PAM;LINKAGE=A

 $D_2(2740)^0$ REFERENCES

NODE=M228

AAIJ	20D PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=60253
REFID=55581

NODE=M203

 $D_3^*(2750)$

$$I(J^P) = \frac{1}{2}(3^-)$$

J^P determined by AAIJ 15Y from the Dalitz plot analysis of $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$ decays.

NODE=M203

 $D_3^*(2750)$ MASS

NODE=M203M

NODE=M203M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2763.1 ± 3.2 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.			
2753 ± 4 ± 6	79k	¹ AAIJ	20D LHCB		$B^- \rightarrow D^{*+} \pi^- \pi^-$
2775.5 ± 4.5 ± 6.5	28k	² AAIJ	16AH LHCB		$B^- \rightarrow D^+ \pi^- \pi^-$
2798 ± 7 ± 7		³ AAIJ	15Y LHCB		$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2761.1 ± 5.1 ± 6.5	14k	AAIJ	13CC LHCB	0	$pp \rightarrow D^{*+} \pi^- X$
2760.1 ± 1.1 ± 3.7	56k	AAIJ	13CC LHCB	0	$pp \rightarrow D^+ \pi^- X$
2771.7 ± 1.7 ± 3.8	20k	AAIJ	13CC LHCB	+	$pp \rightarrow D^0 \pi^+ X$
2752.4 ± 1.7 ± 2.7	23.5k	⁴ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2763.3 ± 2.3 ± 2.3	11.3k	⁴ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2769.7 ± 3.8 ± 1.5	5.7k	^{4,5} DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

2802 ± 11 ± 10		⁶ AAIJ	15Y LHCB		$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
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OCCUR=2

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M203M;LINKAGE=D

² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

NODE=M203M;LINKAGE=C

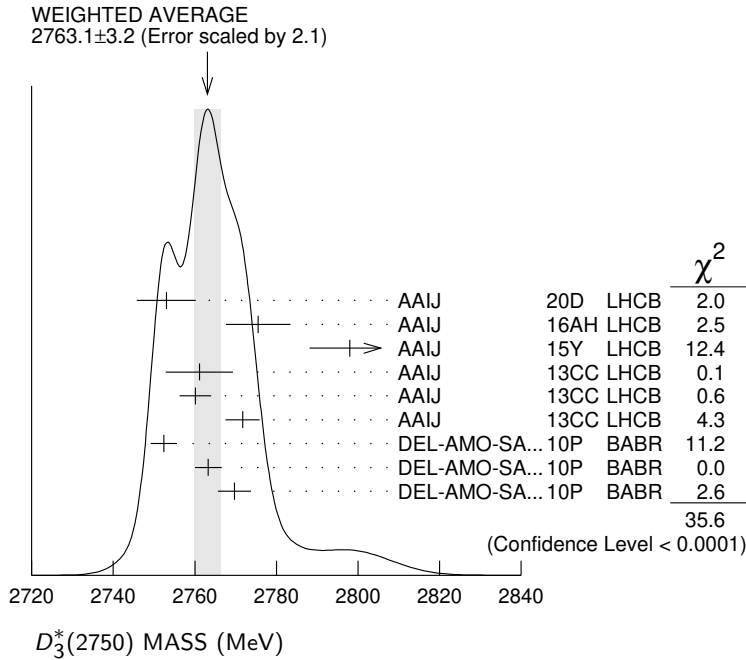
³ Modeling the $\pi^+ \pi^-$ S-wave with the Isobar formalism.⁴ The states observed in the $D^* \pi$ and $D \pi$ final states are not necessarily the same.⁵ At a fixed width of 60.9 MeV.⁶ Modeling the $\pi^+ \pi^-$ S-wave with the K-matrix formalism.

NODE=M203M;LINKAGE=A

NODE=M203M;LINKAGE=DE

NODE=M203M;LINKAGE=DA

NODE=M203M;LINKAGE=B



$D_3^*(2750)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
66 ± 5	OUR AVERAGE				
66 ± 10 ± 14	79k	1 AAIJ	20D	LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
95.3 ± 9.6 ± 34.0	28k	2 AAIJ	16AH	LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
105 ± 18 ± 24		3 AAIJ	15Y	LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
74.4 ± 3.4 ± 37.0	14k	AAIJ	13CC	LHCB 0	$pp \rightarrow D^{*+} \pi^- X$
74.4 ± 3.4 ± 19.1	56k	AAIJ	13CC	LHCB 0	$pp \rightarrow D^+ \pi^- X$
66.7 ± 6.6 ± 10.5	20k	AAIJ	13CC	LHCB +	$pp \rightarrow D^0 \pi^+ X$
71 ± 6 ± 11	23.5k	4 DEL-AMO-SA..10P	BABR		$e^+ e^- \rightarrow D^{*+} \pi^- X$
60.9 ± 5.1 ± 3.6	11.3k	4 DEL-AMO-SA..10P	BABR		$e^+ e^- \rightarrow D^+ \pi^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

154 ± 27 ± 16		5 AAIJ	15Y	LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
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- ¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.
- ² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.
- ³ Modeling the $\pi^+ \pi^-$ S-wave with the Isobar formalism.
- ⁴ The states observed in the $D^* \pi$ and $D \pi$ final states are not necessarily the same.
- ⁵ Modeling the $\pi^+ \pi^-$ S-wave with the K-matrix formalism.

$D_3^*(2750)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D \pi$	seen
Γ_2 $D^+ \pi^-$	seen
Γ_3 $D^0 \pi^\pm$	seen
Γ_4 $D^* \pi$	seen
Γ_5 $D^{*+} \pi^-$	seen

$D_3^*(2750)$ BRANCHING RATIOS

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_5
0.42 ± 0.05 ± 0.11	34.8k	1 DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{(*)+} \pi^- X$	

NODE=M203W

NODE=M203W

OCCUR=2

OCCUR=4

OCCUR=2

OCCUR=2

NODE=M203W;LINKAGE=D

NODE=M203W;LINKAGE=C

NODE=M203W;LINKAGE=A

NODE=M203W;LINKAGE=DE

NODE=M203W;LINKAGE=B

NODE=M203215;NODE=M203

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

NODE=M203220

NODE=M203R01

NODE=M203R01

¹ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

NODE=M203R01;LINKAGE=DE

$D_3^*(2750)$ POLARIZATION AMPLITUDE A_D

NODE=M203PAM

NODE=M203PAM

A polarization amplitude A_D is a parameter that depends on the initial polarization of the $D_3^*(2750)$. For $D_3^*(2750)$ decays the helicity angle, θ_H , distribution varies like $1 + A_D \cos(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_3^*(2750) \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M203PAM

••• We do not use the following data for averages, fits, limits, etc. •••

-0.33±0.28	23.5k	¹ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$
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NODE=M203PAM;LINKAGE=DE

¹ Systematic uncertainties not estimated. The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D_3^*(2750)$ REFERENCES

NODE=M203

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60253
AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57518
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=56609
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55581
DEL-AMO-SA... 10P	PR D82 111101		P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534

NODE=M249

$D_1^*(2760)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

OMITTED FROM SUMMARY TABLE

J^P determined by AAIJ 15V from the Dalitz plot analysis of $B^- \rightarrow D^+ K^- \pi^-$ decays.

NODE=M249

$D_1^*(2760)^0$ MASS

NODE=M249M

NODE=M249M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2781±18±13	2k	¹ AAIJ	15V	LHCB $B^- \rightarrow D^+ K^- \pi^-$

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

NODE=M249M;LINKAGE=A

$D_1^*(2760)^0$ WIDTH

NODE=M249W

NODE=M249W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
177±32±21	2k	¹ AAIJ	15V	LHCB $B^- \rightarrow D^+ K^- \pi^-$

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

NODE=M249W;LINKAGE=A

$D_1^*(2760)^0$ DECAY MODES

NODE=M249215;NODE=M249

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+\pi^-$	seen

DESIG=1

$D_1^*(2760)^0$ BRANCHING RATIOS

NODE=M249225

$\Gamma(D^+\pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	15V	LHCB $B^- \rightarrow D^+ K^- \pi^-$

NODE=M249R01

NODE=M249R01

OCCUR=2

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

NODE=M249R01;LINKAGE=A

$D_1^*(2760)^0$ REFERENCES

AAIJ 15V PR D91 092002 R. Aaij *et al.* (LHCb Collab.) JP
 Also PR D93 119901 (errat.) R. Aaij *et al.* (LHCb Collab.)

NODE=M249

REFID=56575
REFID=57289 $D(3000)^0$

$$I(J^P) = \frac{1}{2}(?)^2$$

NODE=M229

OMITTED FROM SUMMARY TABLE

Both natural- and unnatural-parity components observed depending on the decay mode (AAIJ 13CC).

NODE=M229

 $D(3000)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3214 ± 29 ± 49	28k	¹ AAIJ	16AH LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2971.8 ± 8.7	9.5k	^{2,3} AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
3008.1 ± 4.0	17.6k	^{2,4} AAIJ	13CC LHCB	$pp \rightarrow D^+ \pi^- X$

NODE=M229M

NODE=M229M

¹ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² Systematic uncertainty not estimated.

³ Unnatural parity preferred.

⁴ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0 \pi^+$ final state.

OCCUR=2

NODE=M229M;LINKAGE=D

NODE=M229M;LINKAGE=A

NODE=M229M;LINKAGE=B

NODE=M229M;LINKAGE=C

 $D(3000)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
186 ± 38 ± 72	28k	⁵ AAIJ	16AH LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
188.1 ± 44.8	9.5k	^{6,7} AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
110.5 ± 11.5	17.6k	^{6,8} AAIJ	13CC LHCB	$pp \rightarrow D^+ \pi^- X$

NODE=M229W

NODE=M229W

⁵ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

⁶ Systematic uncertainty not estimated.

⁷ Unnatural parity preferred.

⁸ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0 \pi^+$ final state.

OCCUR=2

NODE=M229W;LINKAGE=D

NODE=M229W;LINKAGE=A

NODE=M229W;LINKAGE=C

NODE=M229W;LINKAGE=B

 $D(3000)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+} \pi^-$	seen

NODE=M229215;NODE=M229

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D(3000)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

NODE=M229PAM

NODE=M229PAM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.5 ± 0.9	9.5k	⁹ AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$

NODE=M229PAM

⁹ Systematic uncertainty not estimated.

NODE=M229PAM;LINKAGE=A

 $D(3000)^0$ REFERENCES

AAIJ 16AH PR D94 072001 R. Aaij *et al.* (LHCb Collab.)
 AAIJ 13CC JHEP 1309 145 R. Aaij *et al.* (LHCb Collab.)

NODE=M229

REFID=57518
REFID=55581

CHARMED, STRANGE MESONS

($C = \pm 1, S = \pm 1$)

(including possibly non- $q\bar{q}$ states)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{* \pm}$$

 $D_s^{* \pm}$

$$I(J^P) = 0(1^-)$$

 $J^P = 1^-$ established by ABLIKIM 23AZ.

NODE=MXXX040

NODE=MXXX040

NODE=S074

NODE=S074

NODE=S074M

NODE=S074M

NODE=S074M

NODE=S074M;LINKAGE=E

NODE=S074DM

NODE=S074DM

NODE=S074DM

NODE=S074DM;LINKAGE=A

NODE=S074W

NODE=S074W

NODE=S074215;NODE=S074

NODE=S074

$D_s^{* \pm}$ MASS

The fit includes $D_s^\pm, D_s^0, D_s^{\pm}, D_s^{* \pm}, D_s^{*0}, D_s^{* \pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.2 ± 0.4 OUR FIT			
2106.6 ± 2.1 ± 2.7	¹ BLAYLOCK	87	MRK3 $e^+ e^- \rightarrow D_s^\pm \gamma X$

¹ Assuming D_s^\pm mass = 1968.7 ± 0.9 MeV.

$m_{D_s^{* \pm}} - m_{D_s^\pm}$

The fit includes $D_s^\pm, D_s^0, D_s^{\pm}, D_s^{* \pm}, D_s^{*0}, D_s^{* \pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
143.8 ± 0.4 OUR FIT				
143.9 ± 0.4 OUR AVERAGE				
143.76 ± 0.39 ± 0.40		GRONBERG	95	CLE2 $e^+ e^-$
144.22 ± 0.47 ± 0.37		BROWN	94	CLE2 $e^+ e^-$
142.5 ± 0.8 ± 1.5		² ALBRECHT	88	ARG $e^+ e^- \rightarrow D_s^\pm \gamma X$
139.5 ± 8.3 ± 9.7	60	AIHARA	84D	TPC $e^+ e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
143.0 ± 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ² H
110 ± 46		BRANDELIK	79	DASP $e^+ e^- \rightarrow D_s^\pm \gamma X$

² Result includes data of ALBRECHT 84B.

$D_s^{* \pm}$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	GRONBERG	95	CLE2 $e^+ e^-$
< 4.5	90	ALBRECHT	88	ARG $E_{cm}^{ee} = 10.2$ GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 4.9	90	BROWN	94	CLE2 $e^+ e^-$
< 22	90	BLAYLOCK	87	MRK3 $e^+ e^- \rightarrow D_s^\pm \gamma X$

D_s^{*+} DECAY MODES

D_s^{*-} modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \gamma$	(93.6 ± 0.4) %
Γ_2 $D_s^+ \pi^0$	(5.77 ± 0.35) %
Γ_3 $D_s^+ e^+ e^-$	(6.7 ± 1.6) × 10 ⁻³
Γ_4 $e^+ \nu_e$	(2.1 $^{+1.2}_{-0.9}$) × 10 ⁻⁵

DESIG=1

DESIG=2

DESIG=3

DESIG=4

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 4 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.0$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-91	
x_3	-38	-4
	x_1	x_2

D_s^{*+} BRANCHING RATIOS

NODE=S074220

 $\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$
 Γ_1 / Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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NODE=S074R1
NODE=S074R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	ASRATYAN	91	HLBC	$\bar{\nu}_\mu \text{Ne}$
seen	ALBRECHT	88	ARG	$e^+ e^- \rightarrow D_s^\pm \gamma X$
seen	AIHARA	84D		
seen	ALBRECHT	84B		
seen	BRANDELIK	79		

 $\Gamma(D_s^+ \pi^0) / \Gamma(D_s^+ \gamma)$
 Γ_2 / Γ_1

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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NODE=S074R2
NODE=S074R2**6.2 ± 0.4 OUR FIT****6.2 ± 0.4 OUR AVERAGE**

$6.16 \pm 0.43 \pm 0.18$	ABLIKIM	23P	BES3	$e^+ e^-$
$6.2 \pm 0.5 \pm 0.6$	AUBERT, BE	05G	BABR	$10.6 e^+ e^- \rightarrow \text{hadrons}$
$6.2 \begin{smallmatrix} +2.0 \\ -1.8 \end{smallmatrix} \pm 2.2$	GRONBERG	95	CLE2	$e^+ e^-$

 $\Gamma(D_s^+ e^+ e^-) / \Gamma(D_s^+ \gamma)$
 Γ_3 / Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=S074R01
NODE=S074R01**7.2 ± 1.7 OUR FIT****7.2 ± 1.5
-1.3 ± 1.0**

38

CRONIN-HEN..12 CLEO $4.17 e^+ e^- \rightarrow \text{hadrons}$
 $\Gamma(e^+ \nu_e) / \Gamma_{\text{total}}$
 Γ_4 / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=S074R02
NODE=S074R02**2.1 ± 1.2
-0.9 ± 0.2**ABLIKIM 23BF BES3 $e^+ e^- \rightarrow D_s^- D_s^{*+}$

$D_s^{*\pm}$ REFERENCES

NODE=S074

ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=62420
ABLIKIM	23BF	PRL 131 141802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62430
ABLIKIM	23P	PR D107 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62059
CRONIN-HEN...	12	PR D86 072005	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=54627
AUBERT, BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50942
GRONBERG	95	PRL 75 3232	J. Gronberg <i>et al.</i>	(CLEO Collab.)	REFID=44568
BROWN	94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)	REFID=43868
ASRATYAN	91	PL B257 525	A.E. Asratyan <i>et al.</i>	(ITEP, BELG, SACL+)	REFID=41582
ALBRECHT	88	PL B207 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40269
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock <i>et al.</i>	(Mark III Collab.)	REFID=40005
ASRATYAN	85	PL 156B 441	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=22887
AIHARA	84D	PRL 53 2465	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=11561
ALBRECHT	84B	PL 146B 111	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22886
BRANDELIK	79	PL 80B 412	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=11442

$D_{s0}^*(2317)^\pm$

 $I(J^P) = 0(0^+)$
 J, P need confirmation.

AUBERT 06P and CHOI 15A do not observe neutral and doubly charged partners of the $D_{s0}^*(2317)^\pm$. See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M172

NODE=M172

$D_{s0}^*(2317)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172M

NODE=M172M

NODE=M172M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2317.8±0.5 OUR FIT				
2318.0±0.7 OUR AVERAGE				
2318.3±1.2±1.2	115	¹ ABLIKIM	18J BES3	4.6 $e^+e^- \rightarrow D_s^{*\pm} D_{s0}^*(2317)^\mp$
2319.6±0.2±1.4	3.1k	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+ \pi^0 X$
2317.3±0.4±0.8	1.0k	² AUBERT	04E BABR	10.6 e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2317.2±1.3	88	³ AUBERT,B	04S BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+ \bar{D}^{(*)}$
2317.2±0.5±0.9	761	⁴ MIKAMI	04 BELL	10.6 e^+e^-
2316.8±0.4±3.0	1.2k	^{4,5} AUBERT	03G BABR	10.6 e^+e^-
2317.6±1.3	273	^{4,6} AUBERT	03G BABR	10.6 e^+e^-
2319.8±2.1±2.0	24	⁴ KROKOVNY	03B BELL	10.6 e^+e^-

OCCUR=2

NODE=M172M;LINKAGE=A

NODE=M172M;LINKAGE=AU

NODE=M172M;LINKAGE=AB

NODE=M172M;LINKAGE=B1

NODE=M172M;LINKAGE=A1

NODE=M172M;LINKAGE=A2

¹ From a fit of the D_s^* recoil mass where the $D_{s0}^*(2317)$ signal is described with a Crystal Ball function convolved with a Gaussian function.

² Supersedes AUBERT 03G.

³ Systematic errors not evaluated.

⁴ Not independent of the corresponding $m_{D_{s0}^*(2317)} - m_{D_s}$.

⁵ From $D_s^+ \rightarrow K^+ K^- \pi^+$ decay.

⁶ From $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ decay.

$m_{D_{s0}^*(2317)^\pm} - m_{D_s^\pm}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172DM

NODE=M172DM

NODE=M172DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
349.4±0.5 OUR FIT				
349.2±0.7 OUR AVERAGE				
348.7±0.5±0.7	761	MIKAMI	04 BELL	10.6 e^+e^-
350.0±1.2±1.0	135	BESSION	03 CLE2	10.6 e^+e^-
351.3±2.1±1.9	24	⁷ KROKOVNY	03B BELL	10.6 e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
349.6±0.4±3.0	1267	^{8,9} AUBERT	03G BABR	10.6 e^+e^-
350.2±1.3	273	^{10,11} AUBERT	03G BABR	10.6 e^+e^-
⁷ Recalculated by us using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.				
⁸ From $D_s^+ \rightarrow K^+ K^- \pi^+$ decay.				
⁹ Recalculated by us using $m_{D_s^+} = 1967.20 \pm 0.03$ MeV.				
¹⁰ From $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ decay.				
¹¹ Recalculated by us using $m_{D_s^+} = 1967.4 \pm 0.2$ MeV. Systematic errors not estimated.				

OCCUR=2

NODE=M172DM;LINKAGE=K3

NODE=M172DM;LINKAGE=A1

NODE=M172DM;LINKAGE=C1

NODE=M172DM;LINKAGE=A2

NODE=M172DM;LINKAGE=C2

$D_{s0}^*(2317)^\pm$ WIDTH

NODE=M172W

NODE=M172W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.8	95	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+ \pi^0 X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
< 4.6	90	761	MIKAMI	04 BELL	10.6 e^+e^-
< 10			AUBERT	03G BABR	10.6 e^+e^-
< 7	90	135	BESSION	03 CLE2	10.6 e^+e^-

$D_{s0}^*(2317)^\pm$ DECAY MODES

NODE=M172215;NODE=M172

 $D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D_s^+ \pi^0$	$(100^{+0}_{-20})\%$	
Γ_2 $D_s^+ \gamma$	$< 5\%$	90%
Γ_3 $D_s^*(2112)^+ \gamma$	$< 6\%$	90%
Γ_4 $D_s^+ \gamma \gamma$	$< 18\%$	95%
Γ_5 $D_s^*(2112)^+ \pi^0$	$< 11\%$	90%
Γ_6 $D_s^+ \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%
Γ_7 $D_s^+ \pi^0 \pi^0$	not seen	

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7;OUR EVAL;→ UNCHECKED ←

 $D_{s0}^*(2317)^\pm$ BRANCHING RATIOS

NODE=M172220

$\Gamma(D_s^+ \pi^0)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
$1.00^{+0.00+0.00}_{-0.14-0.14}$	47	ABLIKIM	18J	BES3	$4.6 e^+ e^- \rightarrow D_s^{*\pm} D_{s0}^*(2317)^\mp$	

NODE=M172R1

NODE=M172R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 1.5k AUBERT 03G BABR $10.6 e^+ e^-$

$\Gamma(D_s^+ \gamma)/\Gamma(D_s^+ \pi^0)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.05	90	MIKAMI	04	BELL	$10.6 e^+ e^-$	
<0.14	95	AUBERT	06P	BABR	$10.6 e^+ e^-$	
<0.052	90	BESSION	03	CLE2	$10.6 e^+ e^-$	

NODE=M172R5

NODE=M172R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(D_s^*(2112)^+ \gamma)/\Gamma(D_s^+ \pi^0)$						Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.059	90	BESSION	03	CLE2	$10.6 e^+ e^-$	
<0.16	95	AUBERT	06P	BABR	$10.6 e^+ e^-$	
<0.18	90	MIKAMI	04	BELL	$10.6 e^+ e^-$	

NODE=M172R6

NODE=M172R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(D_s^+ \gamma \gamma)/\Gamma(D_s^+ \pi^0)$						Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.18	95	AUBERT	06P	BABR	$10.6 e^+ e^-$	
not seen		AUBERT	03G	BABR	$10.6 e^+ e^-$	

NODE=M172R7

NODE=M172R7

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(D_s^*(2112)^+ \pi^0)/\Gamma(D_s^+ \pi^0)$						Γ_5/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.11	90	BESSION	03	CLE2	$10.6 e^+ e^-$	

NODE=M172R8

NODE=M172R8

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma(D_s^+ \pi^0)$						Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.004	90	MIKAMI	04	BELL	$10.6 e^+ e^-$	
<0.005	95	AUBERT	06P	BABR	$10.6 e^+ e^-$	
<0.019	90	BESSION	03	CLE2	$10.6 e^+ e^-$	

NODE=M172R9

NODE=M172R9

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(D_s^+ \pi^0 \pi^0)/\Gamma(D_s^+ \pi^0)$						Γ_7/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.25	95	AUBERT	06P	BABR	$10.6 e^+ e^-$	

NODE=M172R10

NODE=M172R10

$D_{s0}^*(2317)^\pm$ REFERENCES

ABLIKIM	18J	PR D97 051103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58895
CHOI	15A	PR D91 092011	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=56577
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49747
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50195
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)	REFID=49629
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49417
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=49583
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)	REFID=49615

NODE=M172

 $D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M173

NODE=M173

 $D_{s1}(2460)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M173M

NODE=M173M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M173M

2459.5±0.6 OUR FIT Error includes scale factor of 1.1.**2459.6±0.9 OUR AVERAGE** Error includes scale factor of 1.3.2460.1±0.2±0.8 ¹ AUBERT 06P BABR 10.6 e^+e^- 2458.0±1.0±1.0 195 AUBERT 04E BABR 10.6 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

2459.5±1.2±3.7 920 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \gamma X$

OCCUR=2

2458.6±1.0±2.5 560 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^0 \gamma X$

OCCUR=3

2460.2±0.2±0.8 123 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^+ \pi^- X$

OCCUR=4

2458.9±1.5 112 ² AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$ 2461.1±1.6 139 ³ AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$

OCCUR=2

2456.5±1.3±1.3 126 ^{4,5} MIKAMI 04 BELL 10.6 e^+e^- 2459.5±1.3±2.0 152 ^{6,7} MIKAMI 04 BELL 10.6 e^+e^-

OCCUR=2

2459.9±0.9±1.6 60 ^{6,7} MIKAMI 04 BELL 10.6 e^+e^-

OCCUR=3

2459.2±1.6±2.0 57 KROKOVNY 03B BELL 10.6 e^+e^- ¹ The average of the values obtained from the $D_s^+ \gamma, D_s^+ \pi^0 \gamma, D_s^+ \pi^+ \pi^-$ final state.

NODE=M173M;LINKAGE=UB

² Systematic errors not evaluated. From the decay to $D_s^{*+} \pi^0$.

NODE=M173M;LINKAGE=AU

³ Systematic errors not evaluated. From the decay to $D_s^+ \gamma$.

NODE=M173M;LINKAGE=AB

⁴ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$.

NODE=M173M;LINKAGE=B1

⁵ Using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173M;LINKAGE=B2

⁶ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^\pm}$.

NODE=M173M;LINKAGE=B3

⁷ Using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.

NODE=M173M;LINKAGE=B4

 $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$

NODE=M173MD

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M173MD

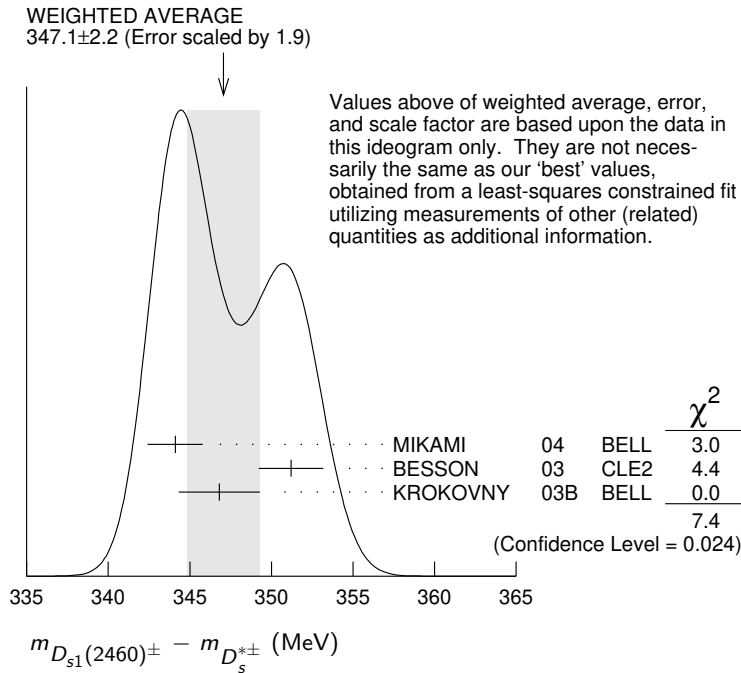
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M173MD

347.3±0.7 OUR FIT Error includes scale factor of 1.2.**347.1±2.2 OUR AVERAGE** Error includes scale factor of 1.9. See the ideogram below.344.1±1.3±1.1 126 MIKAMI 04 BELL 10.6 e^+e^- 351.2±1.7±1.0 41 BESSION 03 CLE2 10.6 e^+e^- 346.8±1.6±1.9 57 ⁸ KROKOVNY 03B BELL 10.6 e^+e^-

⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173MD;LINKAGE=K3



$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$

NODE=M173DM

The fit includes $D^{\pm}, D^0, D_s^{\pm}, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M173DM

491.1±0.6 OUR FIT Error includes scale factor of 1.1.

491.3±1.4 OUR AVERAGE

491.0±1.3±1.9	152	⁹ MIKAMI	04	BELL	10.6 $e^+ e^-$
491.4±0.9±1.5	60	¹⁰ MIKAMI	04	BELL	10.6 $e^+ e^-$

OCCUR=2

⁹ From the decay to $D_s^{\pm} \gamma$.

NODE=M173DM;LINKAGE=M1

¹⁰ From the decay to $D_s^{\pm} \pi^+ \pi^-$.

NODE=M173DM;LINKAGE=M2

$D_{s1}(2460)^{\pm}$ WIDTH

NODE=M173W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M173W

< 3.5 95 123 AUBERT 06P BABR 10.6 $e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$

••• We do not use the following data for averages, fits, limits, etc. •••

< 6.3 95 560 AUBERT 06P BABR 10.6 $e^+ e^- \rightarrow D_s^+ \pi^0 \gamma X$

OCCUR=2

<10 195 AUBERT 04E BABR 10.6 $e^+ e^-$

< 5.5 90 126 MIKAMI 04 BELL 10.6 $e^+ e^-$

< 7 90 41 BESSON 03 CLE2 10.6 $e^+ e^-$

$D_{s1}(2460)^+$ DECAY MODES

NODE=M173215;NODE=M173

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D_s^{*+} \pi^0$	(48 ± 11) %	
Γ_2 $D_s^+ \gamma$	(18 ± 4) %	
Γ_3 $D_s^+ \pi^+ \pi^-$	(4.3± 1.3) %	S=1.1
Γ_4 $D_s^{*+} \gamma$	< 8 %	CL=90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

Γ_5	$D_{s0}^*(2317)^+\gamma$	$(3.7^{+5.0}_{-2.4})\%$	DESIG=5
Γ_6	$D_s^+\pi^0$		DESIG=7
Γ_7	$D_s^+\pi^0\pi^0$		DESIG=8
Γ_8	$D_s^+\gamma\gamma$		DESIG=9

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

NODE=M173220

$\Gamma(D_s^{*+}\pi^0)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE EVTS DOCUMENT ID TECN COMMENT

0.48±0.11 OUR FIT

0.56±0.13±0.09 ¹¹ AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^-\bar{D}^*$

••• We do not use the following data for averages, fits, limits, etc. •••

seen 41 BESSON 03 CLE2 $10.6 e^+ e^-$

¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

NODE=M173R1
NODE=M173R1

NODE=M173R1;LINKAGE=AU

$\Gamma(D_s^+\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE DOCUMENT ID TECN COMMENT

0.18±0.04 OUR FIT

0.16±0.04±0.03 ¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^-\bar{D}^*$

¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.

NODE=M173R6
NODE=M173R6

NODE=M173R6;LINKAGE=AU

$\Gamma(D_s^+\gamma)/\Gamma(D_s^{*+}\pi^0)$ Γ_2/Γ_1

VALUE CL% EVTS DOCUMENT ID TECN COMMENT

0.38 ±0.05 OUR FIT

0.44 ±0.09 OUR AVERAGE

0.55 ±0.13 ±0.08 152 MIKAMI 04 BELL $10.6 e^+ e^-$

0.38 ±0.11 ±0.04 38 KROKOVNY 03B BELL $10.6 e^+ e^-$

••• We do not use the following data for averages, fits, limits, etc. •••

0.274±0.045±0.020 251 ¹³ AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+\bar{D}^*$

< 0.49 90 BESSON 03 CLE2 $10.6 e^+ e^-$

¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-}\pi^0)$ and $B(D_s^-\gamma)$.

NODE=M173R2
NODE=M173R2

NODE=M173R2;LINKAGE=AU

$\Gamma(D_s^+\pi^+\pi^-)/\Gamma(D_s^{*+}\pi^0)$ Γ_3/Γ_1

VALUE CL% EVTS DOCUMENT ID TECN COMMENT

0.090±0.020 OUR FIT Error includes scale factor of 1.2.

0.14 ±0.04 ±0.02 60 MIKAMI 04 BELL $10.6 e^+ e^-$

••• We do not use the following data for averages, fits, limits, etc. •••

<0.08 90 BESSON 03 CLE2 $10.6 e^+ e^-$

NODE=M173R3
NODE=M173R3

$\Gamma(D_s^{*+}\gamma)/\Gamma(D_s^{*+}\pi^0)$ Γ_4/Γ_1

VALUE CL% DOCUMENT ID TECN COMMENT

<0.16 90 BESSON 03 CLE2 $10.6 e^+ e^-$

••• We do not use the following data for averages, fits, limits, etc. •••

<0.31 90 MIKAMI 04 BELL $10.6 e^+ e^-$

NODE=M173R4
NODE=M173R4

$\Gamma(D_{s0}^*(2317)^+\gamma)/\Gamma(D_s^{*+}\pi^0)$					Γ_5/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.22	95	AUBERT	04E	BABR	10.6 e ⁺ e ⁻	NODE=M173R5 NODE=M173R5
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.58	90	BESSION	03	CLE2	10.6 e ⁺ e ⁻	
$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_1/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
0.93±0.09 OUR FIT						
0.97±0.09±0.05		AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R7 NODE=M173R7
$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_2/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
0.35 ±0.04 OUR FIT						
0.337±0.036±0.038		AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R8 NODE=M173R8
$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_3/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
0.083±0.017 OUR FIT Error includes scale factor of 1.2.						
0.077±0.013±0.008		AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R9 NODE=M173R9
$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_4/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.24	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R10 NODE=M173R10
$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_5/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.25	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R11 NODE=M173R11
$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_6/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.042	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R12 NODE=M173R12
$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_7/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.68	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R13 NODE=M173R13
$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$					$\Gamma_8/(\Gamma_1+\Gamma_5)$	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.33	95	AUBERT	06P	BABR	10.6 e ⁺ e ⁻	NODE=M173R14 NODE=M173R14

$D_{s1}(2460)^\pm$ REFERENCES

DOCUMENT ID	TECN	COMMENT	REFID
AUBERT 06N PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51142
AUBERT 06P PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
AUBERT 04E PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49747
AUBERT,B 04S PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50195
MIKAMI 04 PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)	REFID=49629
BESSION 03 PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=49583
KROKOVNY 03B PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)	REFID=49615

NODE=M173

$D_{s1}(2536)^\pm$ $I(J^P) = 0(1^+)$
 J, P need confirmation.Seen in $D^*(2010)^+ K^0$, $D^*(2007)^0 K^+$, and $D_s^+ \pi^+ \pi^-$. Not seen in $D^+ K^0$ or $D^0 K^+$. $J^P = 1^+$ assignment strongly favored.

NODE=M121

NODE=M121

 $D_{s1}(2536)^\pm$ MASS

NODE=M121M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121M

NODE=M121M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2535.11 ± 0.06 OUR FIT				
2535.21 ± 0.28 OUR AVERAGE				
2537.7 ± 0.5 ± 3.1	24	1 ABLIKIM	19P BES3	4.6 $e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$
2535.7 ± 0.6 ± 0.5	46	2 ABAZOV	09G D0	$B_s^0 \rightarrow D_{s1}^- \mu^+ \nu_\mu X$
2534.78 ± 0.31 ± 0.40	182	AUBERT	08B BABR	$B \rightarrow \bar{D}^{(*)} D^* K$
2534.6 ± 0.3 ± 0.7	193	AUBERT	06P BABR	10.6 $e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$
2535.3 ± 0.7	92	3 HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
2534.2 ± 1.2	9	ASRATYAN	94 BEBC	$\nu N \rightarrow D^* K^0 X, D^{*0} K^\pm X$
2535 ± 0.6 ± 1	75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
2535.2 ± 0.5 ± 1.5	28	ALBRECHT	92R ARG	10.4 $e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
2536.6 ± 0.7 ± 0.4		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.9 ± 0.6 ± 2.0		ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2534.1 ± 0.6	116	4 AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2535.08 ± 0.01 ± 0.15	8038	5 LEES	11B BABR	10.6 $e^+ e^- \rightarrow D^{*+} K_S^0 X$
2535.57 ^{+0.44} _{-0.41} ± 0.10	236	6 CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$
2535.3 ± 0.2 ± 0.5	134	7 ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*0} K^+ X$
2534.8 ± 0.6 ± 0.6	44	8 ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535 ± 28		9 ASRATYAN	88 HLBC	$\nu N \rightarrow D_s \gamma \gamma X$

OCCUR=2

NODE=M121M;LINKAGE=D

NODE=M121M;LINKAGE=AB

NODE=M121M;LINKAGE=HI

NODE=M121M;LINKAGE=AU

NODE=M121M;LINKAGE=LE

NODE=M121M;LINKAGE=CH

NODE=M121M;LINKAGE=A

NODE=M121M;LINKAGE=C

NODE=M121M;LINKAGE=B

 $m_{D_{s1}(2536)^\pm} - m_{D_s^*(2111)}$

NODE=M121DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DM

NODE=M121DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
422.9 ± 0.4 OUR FIT			
424 ± 28	ASRATYAN	88 HLBC	$D_s^{*\pm} \gamma$

 $m_{D_{s1}(2536)^\pm} - m_{D^*(2010)^\pm}$

NODE=M121DN

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DN

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
524.85±0.04 OUR FIT				
524.84±0.04 OUR AVERAGE				
524.83±0.01±0.04	8038	¹⁰ LEES	11B BABR	10.6 $e^+e^- \rightarrow D^{*+} K_S^0 X$
525.30 ^{+0.44} _{-0.41} ±0.10	236 ± 30	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$
525.3 ±0.6 ±0.1	41	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*+} K^0 X$
524.7 ±0.6 ±0.2	44	ALEXANDER93	CLE2	$e^+e^- \rightarrow D^{*+} K_S^0 X$
¹⁰ Assuming S-wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to L=0.				

NODE=M121DN

OCCUR=2

NODE=M121DN;LINKAGE=LE

$m_{D_{s1}(2536)^\pm} - m_{D^*(2007)^0}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DP

NODE=M121DP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
528.26±0.05 OUR FIT				
Error includes scale factor of 1.1.				
528.68±0.28 OUR AVERAGE				
528.7 ±1.9 ±0.5	51	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*0} K^+ X$
527.3 ±2.2	29	ACKERSTAFF	97W OPAL	$e^+e^- \rightarrow D^{*0} K^+ X$
528.7 ±0.2 ±0.2	134	ALEXANDER	93 CLE2	$e^+e^- \rightarrow D^{*0} K^+ X$

NODE=M121DP

OCCUR=2

$D_{s1}(2536)^\pm$ WIDTH

NODE=M121W

NODE=M121W

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.92±0.05 OUR AVERAGE				
1.7 ±1.2 ±0.6	24	¹¹ ABLIKIM	19P BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
0.92±0.03±0.04	8038	¹² LEES	11B BABR	10.6 $e^+e^- \rightarrow D^{*+} K_S^0 X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.75±0.23	116	¹³ AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
< 2.5	95 193	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow$ $D_s^+ \pi^+ \pi^- X$
< 3.2	90 75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 2.3	90	ALEXANDER	93 CLEO	$e^+e^- \rightarrow D^{*0} K^+ X$
< 3.9	90	ALBRECHT	92R ARG	10.4 $e^+e^- \rightarrow D^{*0} K^+ X$
< 5.44	90	AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+} K^0 X$
< 4.6	90	ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$

¹¹ From a fit of the D_s^+ recoil mass distribution with an incoherent sum of the S-wave and S-wave Breit-Wigner line shapes.

¹² Assuming S-wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to L=0.

¹³ Systematic uncertainties not evaluated.

NODE=M121W;LINKAGE=A

NODE=M121W;LINKAGE=LE

NODE=M121W;LINKAGE=AU

$D_{s1}(2536)^+$ DECAY MODES

NODE=M121215;NODE=M121

NODE=M121

Branching fractions are given relative to the one **DEFINED AS 1**.

$D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^*(2010)^+ K^0$	(31 ±7) %	DESIG=1
Γ_2 $(D^*(2010)^+ K^0)_{S-wave}$	(22 ±5) %	DESIG=7
Γ_3 $(D^*(2010)^+ K^0)_{D-wave}$		DESIG=9
Γ_4 $K_S^0 D^*(2010)^+$	(17 ±4) %	DESIG=10
Γ_5 $D^+ \pi^- K^+$	$(10.0 \pm 2.5) \times 10^{-3}$	DESIG=8
Γ_6 $D^*(2007)^0 K^+$	(36 ±6) %	DESIG=4
Γ_7 $D^+ K^0$	< 12 %	90% DESIG=2
Γ_8 $D^0 K^+$	< 4 %	90% DESIG=5
Γ_9 $D_s^{*+} \gamma$	possibly seen	DESIG=3
Γ_{10} $D_s^+ \pi^+ \pi^-$	seen	DESIG=6

$D_{s1}(2536)^+$ BRANCHING RATIOS

$\Gamma((D^*(2010)^+ K^0)_{S-wave})/\Gamma(D^*(2010)^+ K^0)$						Γ_2/Γ_1	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT			
0.72±0.05±0.01	5485	BALAGURA	08	BELL	$10.6 e^+ e^- \rightarrow D^{*+} K^0 X$		NODE=M121220
$\Gamma(K_S^0 D^*(2010)^+)/\Gamma(D^*(2007)^0 K^+)$						Γ_4/Γ_6	
VALUE		DOCUMENT ID	TECN	COMMENT			
0.48±0.07±0.02		GAO	23	BELL	$e^+ e^-$ at 10.52 GeV		NODE=M121R00 NODE=M121R00
$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$						Γ_5/Γ_1	
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT			
3.27±0.18±0.37	1264	BALAGURA	08	BELL	$10.6 e^+ e^- \rightarrow D^+ \pi^- K^+ X$		NODE=M121R9 NODE=M121R9
$\Gamma(D^*(2007)^0 K^+)/\Gamma_{total}$						Γ_6/Γ	
VALUE (%)		DOCUMENT ID	TECN	COMMENT			
35.9±4.8±3.5		¹⁴ ABLIKIM	24BN	BES3	$e^+ e^- \rightarrow D_s^+ D_{s1}(2536)^-$		NODE=M121R01 NODE=M121R01
¹⁴ Determined as ratio of exclusive $e^+ e^- \rightarrow D_s^+ [\bar{D}^{*0} K^-]$ and inclusive $e^+ e^- \rightarrow D_s^+ X$ measurements.							
$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$						Γ_6/Γ_1	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT			
1.18±0.16 OUR AVERAGE							
0.88±0.24±0.08	116	AUSHEV	11	BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$		
2.3 ±0.6 ±0.3	236 ± 30	CHEKANOV	09	ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$		
1.32±0.47±0.23	92	¹⁵ HEISTER	02B	ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$		
1.9 $^{+1.1}_{-0.9}$ ±0.4	35	¹⁵ ACKERSTAFF	97W	OPAL	$e^+ e^- \rightarrow D^{*0} K^+ X,$ $D^{*+} K^0 X$		
1.1 ±0.3		ALEXANDER	93	CLEO	$e^+ e^- \rightarrow$ $D^{*0} K^+ X, D^{*+} K^0 X$		
1.4 ±0.3 ±0.2		¹⁶ ALBRECHT	92R	ARG	$10.4 e^+ e^- \rightarrow$ $D^{*0} K^+ X, D^{*+} K^0 X$		
¹⁵ Ratio of the production rates measured in Z^0 decays.							
¹⁶ Evaluated by us from published inclusive cross-sections.							
$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$						Γ_7/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT			
<0.40	90	ALEXANDER	93	CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$		NODE=M121R1 NODE=M121R1
••• We do not use the following data for averages, fits, limits, etc. •••							
<0.43	90	ALBRECHT	89E	ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$		
$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$						Γ_8/Γ_6	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT			
<0.12	90	ALEXANDER	93	CLEO	$e^+ e^- \rightarrow D^{*0} K^+ X$		NODE=M121R4 NODE=M121R4
$\Gamma(D_s^{*+} \gamma)/\Gamma_{total}$						Γ_9/Γ	
VALUE		DOCUMENT ID	TECN	COMMENT			
possibly seen		ASRATYAN	88	HLBC	$\nu N \rightarrow D_s \gamma \gamma X$		NODE=M121R3 NODE=M121R3
$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$						Γ_9/Γ_6	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT			
<0.42	90	ALEXANDER	93	CLEO	$e^+ e^- \rightarrow D^{*0} K^+ X$		NODE=M121R5 NODE=M121R5
$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma_{total}$						Γ_{10}/Γ	
VALUE		DOCUMENT ID	TECN	COMMENT			
seen		AUBERT	06P	BABR	$10.6 e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$		NODE=M121R7 NODE=M121R7

$D_{s1}(2536)^\pm$ REFERENCES

ABLIKIM	24BN	PRL 133 171903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63015
GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)	REFID=62519
ABLIKIM	19P	CP C43 031001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59617
AUSHEV	11	PR D83 051102	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=16505
LEES	11B	PR D83 072003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16773
ABAZOV	09G	PRL 102 051801	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=52652
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BALAGURA	08	PR D77 032001	V. Balagura <i>et al.</i>	(BELLE Collab.)	REFID=52133
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48562
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	94	ZPHY C61 563	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=43667
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
ALEXANDER	93	PL B303 377	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=43316
ALBRECHT	92R	PL B297 425	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=43179
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89E	PL B230 162	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40914
ASRATYAN	88	ZPHY C40 483	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=40916

NODE=M121

$D_{s2}^*(2573)$

$I(J^P) = 0(2^+)$

NODE=M148

$D_{s2}^*(2573)$ MASS

NODE=M148M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2569.1 ±0.8	OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.		
2570.7 ±2.0 ±1.7	62	¹ ABLIKIM 19P	BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
2568.39 ±0.29 ±0.26		AAIJ 14AW	LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
2569.4 ±1.6 ±0.5	82	AAIJ 11A	LHCB	$B_s^- \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
2572.2 ±0.3 ±1.0		AUBERT,BE 06E	BABR	$e^+e^- \rightarrow DKX$
2574.5 ±3.3 ±1.6		ALBRECHT 96	ARG	$e^+e^- \rightarrow D^0 K^+ X$
2573.2 $^{+1.7}_{-1.6}$ ±0.9	217	KUBOTA 94	CLE2	$e^+e^- \sim 10.5$ GeV

NODE=M148M

• • • We do not use the following data for averages, fits, limits, etc. • • •

2570.0 ±4.3	25	² EVDOKIMOV 04	SELX	600 $\Sigma^- A \rightarrow D^0 K^+ X$
2568.6 ±3.2	64	³ HEISTER 02B	ALEP	$e^+e^- \rightarrow D^0 K^+ X$

¹ From a fit of the D_s^+ recoil mass distribution.

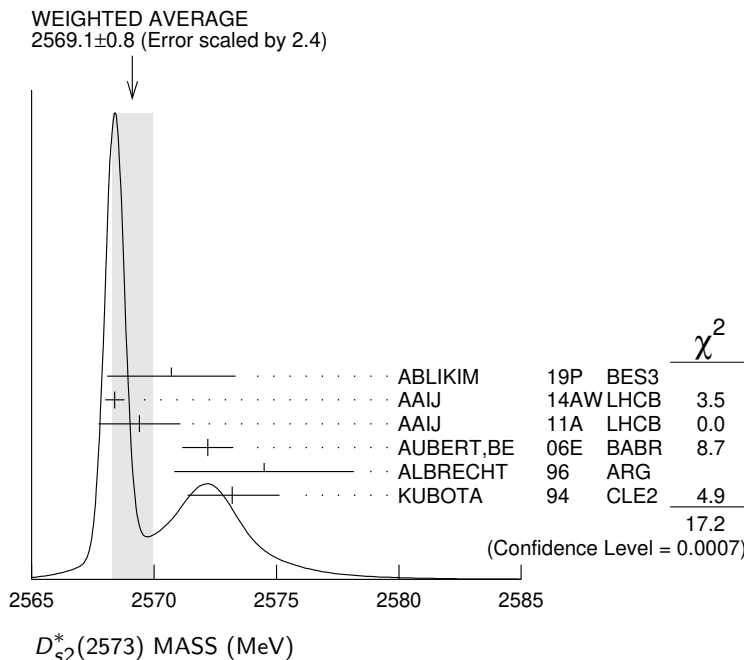
² Not independent of the mass difference below.

³ Calculated using $m_{D^0} = 1864.5 \pm 0.5$ MeV and the mass difference below.

NODE=M148M;LINKAGE=A

NODE=M148M;LINKAGE=EV

NODE=M148M;LINKAGE=HI



$m_{D_{s2}^*(2573)} - m_{D^0}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
704 ±3 ±1	64	HEISTER	02B ALEP	$e^+e^- \rightarrow D^0 K^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
705.4±4.3	25	¹ EVDOKIMOV 04	SELX	600 $\Sigma^- A \rightarrow D^0 K^+ X$
¹ Systematic errors not estimated.				

NODE=M148DM

NODE=M148DM

NODE=M148DM;LINKAGE=EV

 $D_{s2}^*(2573)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.9±0.7 OUR AVERAGE				
17.2±3.6±1.1	62	¹ ABLIKIM	19P BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
16.9±0.5±0.6		AAIJ	14AW LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
12.1±4.5±1.6	82	AAIJ	11A LHCB	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
27.1±0.6±5.6		AUBERT,BE	06E BABR	$e^+e^- \rightarrow DKX$
10.4±8.3±3.0		ALBRECHT	96 ARG	$e^+e^- \rightarrow D^0 K^+ X$
16 $\begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$ ±3	217	KUBOTA	94 CLE2	$e^+e^- \sim 10.5$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
14 $\begin{smallmatrix} +9 \\ -6 \end{smallmatrix}$	25	² EVDOKIMOV 04	SELX	600 $\Sigma^- A \rightarrow D^0 K^+ X$

NODE=M148W

NODE=M148W

¹ From a fit of the D_s^+ recoil mass distribution.² Systematic errors not estimated.NODE=M148W;LINKAGE=A
NODE=M148W;LINKAGE=EV $D_{s2}^*(2573)^+$ DECAY MODES $D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 K^+$	(37±6) %
Γ_2 $D^*(2007)^0 K^+$	not seen
Γ_3 $D^+ K_S^0$	seen
Γ_4 $D^{*+} K_S^0$	seen

NODE=M148215;NODE=M148

NODE=M148

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

 $D_{s2}^*(2573)^+$ BRANCHING RATIOS

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
37.4±3.1±4.6		¹ ABLIKIM	24BN BES3		$e^+e^- \rightarrow D_s^+ D_{s2}^*(2573)^-$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 217 KUBOTA 94 CLE2 ± $e^+e^- \sim 10.5$ GeV¹ Determined as ratio of exclusive $e^+e^- \rightarrow D_s^+ [\bar{D}^0 K^-]$ and inclusive $e^+e^- \rightarrow D_s^+ X$ measurements.

NODE=M148220

NODE=M148R2
NODE=M148R2

NODE=M148R2;LINKAGE=A

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.33	90	KUBOTA	94 CLE2	+	$e^+e^- \sim 10.5$ GeV	

NODE=M148R1
NODE=M148R1

$\Gamma(D^+ K_S^0)/\Gamma(D^0 K^+)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.49±0.10±0.02	GAO	23 BELL	e^+e^- at 10.52 GeV	

NODE=M148R01
NODE=M148R01

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$					Γ_4/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.044±0.005±0.011	2000	¹ AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV	

NODE=M148R00
NODE=M148R00¹ First observation of the $D_{s2}^*(2573)^+ \rightarrow D^{*+} K_S^0$ decay with a significance of 6.9 σ .

NODE=M148R00;LINKAGE=A

$D_{s2}^*(2573)$ REFERENCES

ABLIKIM	24BN	PRL 133 171903	M. Ablikim <i>et al.</i>	(BESIII Collab.)
GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)
ABLIKIM	19P	CP C43 031001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	16AW	JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AW	PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)
ALBRECHT	96	ZPHY C69 405	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KUBOTA	94	PRL 72 1972	Y. Kubota <i>et al.</i>	(CLEO Collab.)

NODE=M148

REFID=63015
 REFID=62519
 REFID=59617
 REFID=60464
 REFID=56105
 REFID=16665
 REFID=51512
 REFID=50337
 REFID=48562
 REFID=44631
 REFID=43781

 $D_{s0}(2590)^+$

$$I(J^P) = 0(0^-)$$

OMITTED FROM SUMMARY TABLE

NODE=M256

 $D_{s0}(2590)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2591 \pm 6 \pm 7$	444	¹ AAIJ	21A LHCb	$B^0 \rightarrow D^- (D^+ K^+ \pi^-)$

¹ The mass is calculated from the position of the T-matrix pole

NODE=M256M

NODE=M256M

NODE=M256M;LINKAGE=B

 $D_{s0}(2590)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$89 \pm 16 \pm 12$	444	¹ AAIJ	21A LHCb	$B^0 \rightarrow D^- (D^+ K^+ \pi^-)$

¹ The width is calculated from the position of the T-matrix pole

NODE=M256W

NODE=M256W

NODE=M256W;LINKAGE=B

 $D_{s0}(2590)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+ K^+ \pi^-$	seen

NODE=M256215;NODE=M256

DESIG=1

 $D_{s0}(2590)^+$ BRANCHING RATIOS

$\Gamma(D^+ K^+ \pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	444	AAIJ	21A LHCb	$B^0 \rightarrow D^- (D^+ K^+ \pi^-)$

NODE=M256225

NODE=M256R01
 NODE=M256R01

 $D_{s0}(2590)^+$ REFERENCES

AAIJ	21A	PRL 126 122002	R. Aaij <i>et al.</i>	(LHCb Collab.)
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NODE=M256

REFID=61092

NODE=M182

$$D_{s1}^*(2700)^\pm$$

$$I(J^P) = 0(1^-)$$

$D_{s1}^*(2700)^+$ MASS

NODE=M182M

NODE=M182M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2714 ± 5 OUR AVERAGE				Error includes scale factor of 1.5. See the ideogram below.
2732.3 ± 4.3 ± 5.8	15.7k	AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
2699 $^{+14}_{-7}$		1 LEES	15C BABR	$B \rightarrow DD^0 K^+$
2709.2 ± 1.9 ± 4.5	52k	2 AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
2710 ± 2 $^{+12}_{-7}$	10.4k	3 AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
2708 ± 9 $^{+11}_{-10}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2694 ± 8 $^{+13}_{-3}$		LEES	15C BABR	$B^0 \rightarrow D^- D^0 K^+$
2707 ± 8 ± 8		LEES	15C BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
2688 ± 4 ± 3		4 AUBERT, BE	06E BABR	10.6 $e^+ e^- \rightarrow DKX$

OCCUR=2

OCCUR=3

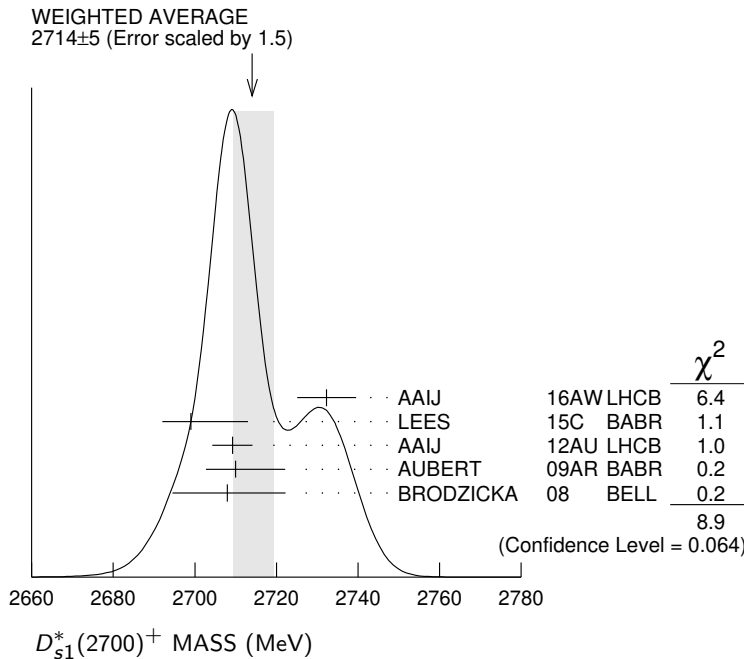
NODE=M182M;LINKAGE=B

NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

- 1 From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.
- 2 From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.
- 3 From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.
- 4 Superseded by AUBERT 09AR.



$D_{s1}^*(2700)^+$ WIDTH

NODE=M182W

NODE=M182W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
122 ± 10 OUR AVERAGE				
136 ± 19 ± 24	15.7k	AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
127 $^{+24}_{-19}$		1 LEES	15C BABR	$B \rightarrow DD^0 K^+$
115.8 ± 7.3 ± 12.1	52k	2 AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
149 ± 7 $^{+39}_{-52}$	10.4k	3 AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
108 ± 23 $^{+36}_{-31}$	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

145	± 24	$\begin{matrix} +22 \\ -14 \end{matrix}$	LEES	15C	BABR	$B^0 \rightarrow D^- D^0 K^+$
113	± 21	$\begin{matrix} +20 \\ -16 \end{matrix}$	LEES	15C	BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
112	± 7	± 36	⁴ AUBERT, BE	06E	BABR	$10.6 e^+ e^- \rightarrow DKX$

OCCUR=2

OCCUR=3

¹ From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.

² From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{s,J}^*(2860)^+$.

³ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

⁴ Superseded by AUBERT 09AR.

NODE=M182W;LINKAGE=A

NODE=M182W;LINKAGE=AA

NODE=M182W;LINKAGE=AB

NODE=M182W;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ DECAY MODES

NODE=M182215;NODE=M182

Mode	Fraction (Γ_i/Γ)
Γ_1 DK	
Γ_2 $D^0 K^+$	seen
Γ_3 $D^+ K_S^0$	seen
Γ_4 $D^* K$	
Γ_5 $D^{*0} K^+$	seen
Γ_6 $D^{*+} K_S^0$	seen

DESIG=2

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

$D_{s1}^*(2700)^\pm$ BRANCHING RATIOS

NODE=M182225

$\Gamma(D^* K)/\Gamma(DK)$

 Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.91±0.13±0.12	10.4k	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$

NODE=M182R01

NODE=M182R01

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$

 Γ_5/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.88±0.14±0.14	7716	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$

NODE=M182R02

NODE=M182R02

¹ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.

NODE=M182R02;LINKAGE=AU

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$

 Γ_6/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.14±0.39±0.23	2700	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$

NODE=M182R03

NODE=M182R03

¹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.

NODE=M182R03;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ REFERENCES

NODE=M182

AAIJ	16AW	JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	15C	PR D91 052002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	12AU	JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AR	PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)
AUBERT, BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=60464

REFID=56412

REFID=54735

REFID=53135

REFID=52144

REFID=51512

$D_{s1}^*(2860)^\pm$

$I(J^P) = 0(1^-)$

OMITTED FROM SUMMARY TABLE

was $D_{sJ}^*(2860)$ J^P consistent with 1^- from angular analysis of AAIJ 14AW.

NODE=M196

 $D_{s1}^*(2860)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2859±12±24	¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196

NODE=M196M

NODE=M196M

NODE=M196M;LINKAGE=A

 $D_{s1}^*(2860)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
159±23±77	¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196W

NODE=M196W

NODE=M196W;LINKAGE=A

 $D_{s1}^*(2860)^\pm$ REFERENCESAAIJ 14AW PRL 113 162001 R. Aaij *et al.* (LHCb Collab.) JP

NODE=M196

REFID=56105

NODE=M226

 $D_{s3}^*(2860)^\pm$

$I(J^P) = 0(3^-)$

J^P consistent with 3^- from angular analysis of AAIJ 14AW. Observed by AUBERT, BE 06E and AUBERT 09AR in inclusive production of DK and D^*K in e^+e^- annihilation.

NODE=M226

 $D_{s3}^*(2860)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2860.5±2.6±6.5		¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2867.1±4.3±1.9 3.1k AAIJ 16AW LHCB $pp \rightarrow D^{*+} K_S^0 X$ at 7, 8

2866.1±1.0±6.3 36k ^{2,3} AAIJ 12AU LHCB $pp \rightarrow (DK)^+ X$ at 7 TeV

2862 ±2 $^{+5}_{-2}$ 3122 ^{2,4} AUBERT 09AR BABR $e^+e^- \rightarrow D^{(*)} K X$

2856.6±1.5±5.0 ⁵ AUBERT, BE 06E BABR $e^+e^- \rightarrow DK X$

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

² Possible contribution from the $D_{s1}^*(2860)$ state.

³ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M226M

NODE=M226M

NODE=M226M;LINKAGE=A

NODE=M226M;LINKAGE=D

NODE=M226M;LINKAGE=E

NODE=M226M;LINKAGE=C

NODE=M226M;LINKAGE=B

 $D_{s3}^*(2860)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
53 ± 7 ± 7		¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

NODE=M226W

NODE=M226W

• • • We do not use the following data for averages, fits, limits, etc. • • •

50 ±11 ±13	3.1k	AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$	at 7, 8 TeV
69.9 ± 3.2 ± 6.6	36k	2,3 AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$	at 7 TeV
48 ± 3 ± 6	3122	2,4 AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	
47 ± 7 ± 10		5 AUBERT, BE	06E BABR	$e^+ e^- \rightarrow DK X$	

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

² Possible contribution from the $D_{s1}^*(2860)$ state.

³ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{s,J}^*(2860)^+$.

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M226W;LINKAGE=A

NODE=M226W;LINKAGE=D

NODE=M226W;LINKAGE=E

NODE=M226W;LINKAGE=C

NODE=M226W;LINKAGE=B

$D_{s3}^*(2860)^\pm$ DECAY MODES

NODE=M226215;NODE=M226

Mode	Fraction (Γ_i/Γ)
Γ_1 DK	
Γ_2 $D^0 K^+$	seen
Γ_3 $D^+ K_S^0$	seen
Γ_4 $D^* K$	
Γ_5 $D^{*0} K^+$	seen
Γ_6 $D^{*+} K_S^0$	seen

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

$D_{s3}^*(2860)^\pm$ BRANCHING RATIOS

NODE=M226225

$\Gamma(D^* K)/\Gamma(DK)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
	1.10 ± 0.15 ± 0.19	3122	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	

NODE=M226R01

NODE=M226R01

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M226R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_2
	1.04 ± 0.17 ± 0.20	2241	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	

NODE=M226R02

NODE=M226R02

¹ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.

NODE=M226R02;LINKAGE=AU

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_3
	1.38 ± 0.35 ± 0.49	881	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	

NODE=M226R03

NODE=M226R03

¹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.

NODE=M226R03;LINKAGE=AU

$D_{s3}^*(2860)^\pm$ REFERENCES

NODE=M226

AAIJ	16AW JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60464
AAIJ	14AW PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=56105
AAIJ	12AU JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54735
AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53135
AUBERT, BE	06E PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51512

$D_{sJ}(3040)^\pm$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE

Observed by AUBERT 09AR in inclusive production of $D^* K$ in $e^+ e^-$ annihilation.

NODE=M197

NODE=M197

 $D_{sJ}(3040)^+$ MASS

NODE=M197M

NODE=M197M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3044 \pm 8_{-5}^{+30}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

 $D_{sJ}(3040)^+$ WIDTH

NODE=M197W

NODE=M197W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$239 \pm 35_{-42}^{+46}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

 $D_{sJ}(3040)^\pm$ DECAY MODES

NODE=M197215;NODE=M197

Mode

Γ_1	$D^* K$
Γ_2	$D^{*0} K^+$
Γ_3	$D^{*+} K_S^0$

DESIG=1

DESIG=2

DESIG=3

 $D_{sJ}(3040)^\pm$ REFERENCES

NODE=M197

REFID=53135

AUBERT 09AR PR D80 092003 B. Aubert *et al.* (BABAR Collab.)**BOTTOM MESONS
($B = \pm 1$)**

NODE=MXXX045

$$B^+ = u\bar{b}, B^0 = d\bar{b}, \bar{B}^0 = \bar{d}b, B^- = \bar{u}b, \text{ similarly for } B^{*'}\text{'s}$$

NODE=MXXX045

NODE=M244

 $B_1(5721)$

$$I(J^P) = \frac{1}{2}(1^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M244

 $B_1(5721)$ MASS

NODE=M244205

 $B_1(5721)^+$ mass

NODE=M244M+

OUR FIT uses $m_{B^{*0}}$ and $m_{B_1^+} - m_{B^{*0}}$ to determine $m_{B_1(5721)^+}$.NODE=M244M+
NODE=M244M+

VALUE (MeV)	DOCUMENT ID
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 $5726.0_{-2.7}^{+2.5}$ OUR FIT **$m_{B_1^+} - m_{B^{*0}}$** NODE=M244DM+
NODE=M244DM+

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 $401.2_{-2.7}^{+2.4}$ OUR FIT **$401.2_{-2.7}^{+2.4}$ OUR AVERAGE**

$400.5 \pm 1.8 \pm 3.1$	8k	1 AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
$402 \pm 3_{-3}^{+1}$		2 AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

- ¹ AAIJ 15AB reports $[m_{B_1^+} - m_{B^0}] - (m_{B^{*0}} - m_{B^0}) - m_{\pi^+} = 260.9 \pm 1.8 \pm 3.1$ MeV which we adjust by the π^+ mass and assume $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.
- ² AALTONEN 14I reports $m_{B_1(5721)^+} - m_{B^{*0}} - m_{\pi^+} = 262 \pm 3^{+1}_{-3}$ MeV which we adjusted by the π^+ mass.

NODE=M244DM+;LINKAGE=A

NODE=M244DM+;LINKAGE=AA

 $B_1(5721)^0$ mass

OUR FIT uses mass differences measurements listed below to determine the mass

$$m_{B_1(5721)^0}$$

VALUE (MeV)	DOCUMENT ID
5726.1±1.2 OUR FIT	Error includes scale factor of 1.2.

NODE=M244M0
NODE=M244M0

NODE=M244M0

 $m_{B_1^0} - m_{B^+}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
446.7±1.2 OUR FIT	Error includes scale factor of 1.2.		
441.5±2.4±1.3	¹ ABAZOV	07T D0	$\rho\bar{p}$ at 1.96 TeV

NODE=M244DM0
NODE=M244DM0

• • • We do not use the following data for averages, fits, limits, etc. • • •

446.2 ^{+1.9+1.0} _{-2.1-1.2}	¹ AALTONEN	09D CDF	Repl. by AALTONEN 14I
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¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$.

NODE=M244DM0;LINKAGE=AA

 $m_{B_1^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
401.4±1.2 OUR FIT	Error includes scale factor of 1.2.			
402.8±1.1 OUR AVERAGE				
403.4±0.7±1.5	35k	¹ AAIJ	15AB LHCB	$\rho\rho$ at 7, 8 TeV
402.3±0.9 ^{+1.1} _{-1.2}		² AALTONEN	14I CDF	$\rho\bar{p}$ at 1.96 TeV

NODE=M244DM1
NODE=M244DM1**402.8±1.1 OUR AVERAGE**

403.4±0.7±1.5	35k	¹ AAIJ	15AB LHCB	$\rho\rho$ at 7, 8 TeV
402.3±0.9 ^{+1.1} _{-1.2}		² AALTONEN	14I CDF	$\rho\bar{p}$ at 1.96 TeV

¹ AAIJ 15AB reports $[m_{B_1^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 263.9 \pm 0.7 \pm 1.4$ MeV which we adjust by the π^- mass and $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.² AALTONEN 14I reports $m_{B_1(5721)^0} - m_{B^{*+}} - m_{\pi^-} = 262.7 \pm 0.9^{+1.1}_{-1.2}$ MeV which we adjusted by the π^- mass.

NODE=M244DM1;LINKAGE=B

NODE=M244DM1;LINKAGE=AA

 $B_1(5721)$ WIDTH

NODE=M244210

 $B_1(5721)^+$ width

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31 ± 6 OUR AVERAGE	Error includes scale factor of 1.1.			
29.1± 3.6± 4.3	8k	AAIJ	15AB LHCB	$\rho\rho$ at 7, 8 TeV
49 ^{+12 +2} _{-10 -13}		AALTONEN	14I CDF	$\rho\bar{p}$ at 1.96 TeV

NODE=M244W+
NODE=M244W+ **$B_1(5721)^0$ width**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.5±3.4 OUR AVERAGE	Error includes scale factor of 1.1.			
30.1±1.5±3.5	35k	AAIJ	15AB LHCB	$\rho\rho$ at 7, 8 TeV
23 ±3 ±4		AALTONEN	14I CDF	$\rho\bar{p}$ at 1.96 TeV

NODE=M244W0
NODE=M244W0 **$B_1(5721)$ DECAY MODES**

NODE=M244215;NODE=M244

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^* \pi$	seen

DESIG=1

 $B_1(5721)$ BRANCHING RATIOS

NODE=M244220

$\Gamma(B^* \pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
seen	AAIJ	15AB LHCB	±0	$\rho\rho$ at 7, 8 TeV	
seen	AALTONEN	14I CDF	±	$\rho\bar{p}$ at 1.96 TeV	
seen	AALTONEN	09D CDF	0	$\rho\bar{p}$ at 1.96 TeV	
seen	¹ ABAZOV	07T D0	0	$\rho\bar{p}$ at 1.96 TeV	

NODE=M244R01
NODE=M244R01

OCCUR=2

¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$ with $B^{*+} \rightarrow B^+ \gamma$ and $B^+ \rightarrow J/\psi \pi^+$.

NODE=M244R01;LINKAGE=AB

$B_1(5721)$ REFERENCES

AAJ	15AB	JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09D	PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	07T	PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M244

REFID=56628
REFID=56029
REFID=52700
REFID=52014

NODE=M151

 $B_j^*(5732)$

$$I(J^P) = ?(??)$$

OMITTED FROM SUMMARY TABLE

Signal can be interpreted as stemming from several narrow and broad resonances.

NODE=M151

 $B_j^*(5732)$ MASS

NODE=M151M

NODE=M151M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5698 ± 8 OUR AVERAGE	Error includes scale factor of 1.2.			
5710 ± 20		¹ AFFOLDER	01F CDF	$\rho\bar{\rho}$ at 1.8 TeV
5695 ⁺¹⁷ ₋₁₉		² BARATE	98L ALEP	$e^+e^- \rightarrow Z$
5704 ± 4 ± 10	1944	³ BUSKULIC	96D ALEP	$E_{cm}^{ee} = 88-94$ GeV
5732 ± 5 ± 20	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88-94$ GeV
5681 ± 11	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5713 ± 2		⁴ ACCIARRI	99N L3	$e^+e^- \rightarrow Z$

¹ AFFOLDER 01F uses the reconstructed B meson through semileptonic decay channels. The fraction of light B mesons that are produced at $L=1$ B^{**} states is measured to be $0.28 \pm 0.06 \pm 0.03$.² BARATE 98L uses fully reconstructed B mesons to search for B^{**} production in the $B\pi^\pm$ system. In the framework of heavy quark symmetry (HQS), they also measured the mass of B_2^* to be 5739_{-11}^{+8+6} MeV/ c^2 and the relative production rate of $B(b \rightarrow B_2^* \rightarrow B^{(*)}\pi)/B(b \rightarrow B_{u,d}) = (31 \pm 9_{-5}^{+6})\%$.³ Using $m_{B\pi} - m_B = 424 \pm 4 \pm 10$ MeV.⁴ ACCIARRI 99N uses inclusive reconstructed B mesons to search for B^{**} production in the $B^{(*)}\pi^\pm$ system. In the framework of HQET, they measured the mass of B_1^* and B_2^* to be $5670 \pm 10 \pm 13$ MeV and $5768 \pm 5 \pm 6$ with the $B(b \rightarrow B^{**}) = (32 \pm 3 \pm 6) \times 10^{-2}$. They also reported the evidence for the existence of an excited B -meson state or mixture of states in the region 5.9–6.0 GeV.

NODE=M151M;LINKAGE=MF

NODE=M151M;LINKAGE=B

NODE=M151M;LINKAGE=A

NODE=M151M;LINKAGE=N

 $B_j^*(5732)$ WIDTH

NODE=M151W

NODE=M151W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
128 ± 18 OUR AVERAGE				
145 ± 28	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88-94$ GeV
116 ± 24	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

 $B_j^*(5732)$ DECAY MODES

NODE=M151215;NODE=M151

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^*\pi + B\pi$	seen
Γ_2 $B^*\pi(X)$	[a] (85 ± 29) %

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

[a] X refers to decay modes with or without additional accompanying decay particles.

LINKAGE=151

 $B_j^*(5732)$ BRANCHING RATIOS

NODE=M151220

NODE=M151220

X refers to decay modes with or without additional accompanying decay particles.

$\Gamma(B^*\pi(X))/\Gamma_{total}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
0.85^{+0.26}_{-0.27} ± 0.12	ABBIENDI	02E OPAL	$e^+e^- \rightarrow Z$

NODE=M151R1
NODE=M151R1

$B_2^*(5732)$ REFERENCES

ABBIENDI	02E	EPJ C23 437	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
AFFOLDER	01F	PR D64 072002	T. Affolder <i>et al.</i>	(CDF Collab.)
ACCIARRI	99N	PL B465 323	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARATE	98L	PL B425 215	R. Barate <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96D	ZPHY C69 393	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	95B	PL B345 598	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	95E	ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)

NODE=M151

REFID=48742
REFID=48369
REFID=47247
REFID=46082
REFID=44677
REFID=44131
REFID=44182 **$B_2^*(5747)$**

$$I(J^P) = \frac{1}{2}(2^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M245

NODE=M245

 $B_2^*(5747)$ MASS

NODE=M245205

 $B_2^*(5747)^+$ mass

NODE=M245M+

OUR FIT uses m_{B^0} and $m_{B_2^{*+}} - m_{B^0}$ to determine $m_{B_2^*(5747)^+}$.NODE=M245M+
NODE=M245M+

VALUE (MeV)	DOCUMENT ID
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5737.3±0.7 OUR FIT **$m_{B_2^{*+}} - m_{B^0}$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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457.5 ±0.7 OUR FIT**457.5 ±0.7 OUR AVERAGE**457.62±0.72±0.40 4k ¹ AAIJ 15AB LHCB $p\bar{p}$ at 7, 8 TeV457.3 ±1.3 $^{+0.3}_{-0.9}$ ² AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeVNODE=M245DM+
NODE=M245DM+

¹ AAIJ 15AB reports $[m_{B_2^{*+}} - m_{B^0}] - m_{\pi^+} = 318.1 \pm 0.7 \pm 0.4$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_2^*(5747)^+} - m_{B^0} - m_{\pi^+} = 317.7 \pm 1.2^{+0.3}_{-0.9}$ MeV which we adjusted by the π^+ mass.

NODE=M245DM+;LINKAGE=B

NODE=M245DM+;LINKAGE=A

 $B_2^*(5747)^0$ mass

NODE=M245M0

OUR FIT uses m_{B^+} , $m_{B_1^0} - m_{B^+}$, and mass differences below to determine $m_{B_2^*(5747)^0}$. The -0.659 correlation between statistical uncertainties of $m_{B_1^0} - m_{B^+}$ and $m_{B_2^{*0}} - m_{B_1^0}$ measurements reported by ABAZOV 07T is taken into account.

NODE=M245M0

VALUE (MeV)	DOCUMENT ID
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5739.6±0.7 OUR FIT Error includes scale factor of 1.4.

NODE=M245M0

 $m_{B_2^{*0}} - m_{B_1^0}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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13.5±1.4 OUR FIT Error includes scale factor of 1.3.**26.2±3.1±0.9** ¹ ABAZOV 07T D0 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

14.9 $^{+2.2+1.2}_{-2.5-1.4}$ ¹ AALTONEN 09D CDF Repl. by AALTONEN 14l

¹ Observed in $B_2^{*0} \rightarrow B^{*+}\pi^-$ and $B_2^{*0} \rightarrow B^+\pi^-$.

NODE=M245DM0
NODE=M245DM0

NODE=M245DM0;LINKAGE=AB

 $m_{B_2^{*0}} - m_{B^+}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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460.2 ±0.6 OUR FIT Error includes scale factor of 1.4.**459.9 ±0.8 OUR AVERAGE** Error includes scale factor of 1.8.460.18±0.37±0.33 17k ¹ AAIJ 15AB LHCB $p\bar{p}$ at 7, 8 TeV457.5 ±1.2 $^{+0.8}_{-0.9}$ ² AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeVNODE=M245DM2
NODE=M245DM2

¹ AAIJ 15AB reports $[m_{B_2^{*0}} - m_{B^+}] - m_{\pi^-} = 320.6 \pm 0.4 \pm 0.3$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_2^*(5747)^0} - m_{B^+} - m_{\pi^-} = 317.9 \pm 1.2^{+0.8}_{-0.9}$ MeV which we adjusted by the π^- mass.

NODE=M245DM2;LINKAGE=A

NODE=M245DM2;LINKAGE=AA

$B_2^*(5747)$ WIDTH

NODE=M245210

 $B_2^*(5747)^+$ width

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ±5 OUR AVERAGE	Error includes scale factor of 2.2.			
23.6±2.0±2.1	4k	AAIJ	15AB LHCB	pp at 7, 8 TeV
11 ⁺⁴ ₋₃ ⁺³ ₋₄		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

NODE=M245W+
NODE=M245W+ **$B_2^*(5747)^0$ width**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
24.2±1.7 OUR AVERAGE				
24.5±1.0±1.5	17k	AAIJ	15AB LHCB	pp at 7, 8 TeV
22 ⁺³ ₋₂ ⁺⁴ ₋₅		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
••• We do not use the following data for averages, fits, limits, etc. •••				
22.7 ^{+3.8} _{-3.2} ^{+3.2} _{-10.2}		AALTONEN	09D CDF	Repl. by AALTONEN 14I

NODE=M245W0
NODE=M245W0 **$B_2^*(5747)$ DECAY MODES**

NODE=M245215;NODE=M245

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	seen
Γ_2 $B^*\pi$	seen

DESIG=1

DESIG=2

 $B_2^*(5747)$ BRANCHING RATIOS

NODE=M245220

$\Gamma(B\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
seen		4k,17k	AAIJ	15AB LHCB	±0	pp at 7, 8 TeV	
seen			AALTONEN	14I CDF	±	$p\bar{p}$ at 1.96 TeV	
seen			AALTONEN	09D CDF	0	$p\bar{p}$ at 1.96 TeV	
seen			ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV	

NODE=M245R01
NODE=M245R01

$\Gamma(B^*\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ
seen		4k,17k	AAIJ	15AB LHCB	±0	pp at 7, 8 TeV	
seen			AALTONEN	09D CDF	0	$p\bar{p}$ at 1.96 TeV	
seen			ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV	

NODE=M245R02
NODE=M245R02

$\Gamma(B^*\pi)/\Gamma(B\pi)$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ_1
0.84±0.27 OUR AVERAGE							
0.71±0.14±0.30		17k	AAIJ	15AB LHCB	0	pp at 7, 8 TeV	
1.0 ±0.5 ±0.8		4k	AAIJ	15AB LHCB	±	pp at 7, 8 TeV	
1.10±0.42±0.31			¹ ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV	

NODE=M245R03
NODE=M245R03

¹ Converted from measured ratio of $R = B(B_2^{*0} \rightarrow B^{*+}\pi^-) / B(B_2^{*0} \rightarrow B^{(*)+}\pi^-)$
= 0.475 ± 0.095 ± 0.069.

OCCUR=2

NODE=M245R03;LINKAGE=AB

 $B_2^*(5747)$ REFERENCES

NODE=M245

AAIJ	15AB	JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09D	PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	07T	PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=56628
REFID=56029
REFID=52700
REFID=52014

$B_J(5840)$

$$I(J^P) = \frac{1}{2}(?^?)$$

I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M246

NODE=M246

 $B_J(5840)$ MASS

NODE=M246205

 $B_J(5840)^+$ MASS

NODE=M246M+

OUR FIT uses m_{B^0} and $m_{B_J(5840)^+} - m_{B^0}$ to determine $m_{B_J(5840)^+}$.NODE=M246M+
NODE=M246M+

VALUE (MeV)	DOCUMENT ID
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5851±19 OUR FIT **$m_{B_J(5840)^+} - m_{B^0}$** NODE=M246DM+
NODE=M246DM+

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
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571±19 OUR FIT**571±13±14** 7k 1 AAIJ 15AB LHCB pp at 7, 8 TeV

••• We do not use the following data for averages, fits, limits, etc. •••

595±26±14 7k 2 AAIJ 15AB LHCB pp at 7, 8 TeV

OCCUR=2

¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 431 \pm 13 \pm 14$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 455 \pm 26 \pm 14$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246DM+;LINKAGE=A

NODE=M246DM+;LINKAGE=B

 $m_{B_J(5840)^+} - m_{B^{*0}}$ NODE=M246DM1
NODE=M246DM1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

565±15±14 7k 1 AAIJ 15AB LHCB pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^+} = 425 \pm 15 \pm 14$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246DM1;LINKAGE=A

 $B_J(5840)^0$ MASS

NODE=M246M0

OUR FIT uses m_{B^+} and $m_{B_J(5840)^0} - m_{B^+}$ to determine $m_{B_J(5840)^0}$.NODE=M246M0
NODE=M246M0

VALUE (MeV)	DOCUMENT ID
-------------	-------------

5863±9 OUR FIT **$m_{B_J(5840)^0} - m_{B^+}$** NODE=M246DM0
NODE=M246DM0

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
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584± 9 OUR FIT**584± 5±7** 12k 1 AAIJ 15AB LHCB pp at 7, 8 TeV

••• We do not use the following data for averages, fits, limits, etc. •••

610±22±7 12k 2 AAIJ 15AB LHCB pp at 7, 8 TeV

OCCUR=2

¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 471 \pm 22 \pm 7$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246DM0;LINKAGE=A

NODE=M246DM0;LINKAGE=B

$m_{B_J(5840)^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$584 \pm 5 \pm 7$	12k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
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¹ AAIJ 15AB reports $[m_{B^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV

which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246DM2
NODE=M246DM2

NODE=M246DM2;LINKAGE=A

 $B_J(5840)$ WIDTH

NODE=M246210

 $B_J(5840)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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$224 \pm 24 \pm 80$	7k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$215 \pm 27 \pm 80$	7k	² AAIJ	15AB LHCB	pp at 7, 8 TeV
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$229 \pm 27 \pm 80$	7k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV
---------------------	----	-------------------	-----------	------------------

¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246W+
NODE=M246W+

OCCUR=2

OCCUR=3

NODE=M246W+;LINKAGE=A

NODE=M246W+;LINKAGE=B

NODE=M246W+;LINKAGE=C

 $B_J(5840)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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$127 \pm 17 \pm 34$	12k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$107 \pm 20 \pm 34$	12k	² AAIJ	15AB LHCB	pp at 7, 8 TeV
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$119 \pm 17 \pm 34$	12k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV
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¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246W0
NODE=M246W0

OCCUR=2

OCCUR=3

NODE=M246W0;LINKAGE=A

NODE=M246W0;LINKAGE=B

NODE=M246W0;LINKAGE=C

 $B_J(5840)$ DECAY MODES

NODE=M246215;NODE=M246

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^* \pi$	seen
Γ_2 $B \pi$	possibly seen

DESIG=1

DESIG=2

 $B_J(5840)$ BRANCHING RATIOS

NODE=M246220

$\Gamma(B^* \pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
---	-------	------	-------------	------	-----	---------	-------------------

seen		7k	AAIJ	15AB LHCB	\pm	pp at 7, 8 TeV	
------	--	----	------	-----------	-------	------------------	--

seen		12k	AAIJ	15AB LHCB	0	pp at 7, 8 TeV	
------	--	-----	------	-----------	---	------------------	--

NODE=M246R01
NODE=M246R01

OCCUR=2

$\Gamma(B \pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ
---------------------------------------	-------	------	-------------	------	-----	---------	-------------------

possibly seen		7k	¹ AAIJ	15AB LHCB	\pm	pp at 7, 8 TeV	
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possibly seen			¹ AAIJ	15AB LHCB	0	pp at 7, 8 TeV	
---------------	--	--	-------------------	-----------	---	------------------	--

NODE=M246R02
NODE=M246R02

OCCUR=2

¹ A $B \pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^* \pi$ is allowed.

NODE=M246R02;LINKAGE=A

 $B_J(5840)$ REFERENCES

NODE=M246

AAIJ	15AB JHEP 1504 024	R. Aaij et al.	(LHCb Collab.)
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REFID=56628

$B_J(5970)$

$$I(J^P) = \frac{1}{2}(??)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M248

NODE=M248

NODE=M248205

NODE=M248M+

NODE=M248M+

NODE=M248M+

NODE=M248DM+

NODE=M248DM+

 $B_J(5970)$ MASS **$B_J(5970)^+$ MASS**OUR FIT uses m_{B^0} and $m_{B_J(5970)^+} - m_{B^0}$ to determine $m_{B_J(5970)^+}$.

VALUE (MeV)

DOCUMENT ID

5965 ± 5 OUR FIT **$m_{B_J(5970)^+} - m_{B^0}$**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

685 ± 5 OUR FIT**685 ± 5 OUR AVERAGE**

685.3 ± 4.1 ± 2.5

2k

¹ AAIJ

15AB LHCB

 pp at 7, 8 TeV

681 ± 5 ± 12

1.4k

² AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

686.8 ± 4.5 ± 2.5

2k

³ AAIJ

15AB LHCB

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 545.8 \pm 4.1 \pm 2.5$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AALTONEN 14l reports $m_{B_J(5970)^+} - m_{B^0} - m_{\pi^+} = 541 \pm 5 \pm 12$ MeV which we adjusted by the π^+ mass.³ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 547 \pm 5 \pm 3$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

OCCUR=2

NODE=M248DM+;LINKAGE=B

NODE=M248DM+;LINKAGE=A

NODE=M248DM+;LINKAGE=C

 $m_{B_J(5970)^+} - m_{B^{*0}}$

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

686.0 ± 4.0 ± 2.5

2k

¹ AAIJ

15AB LHCB

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*0}} - m_{B^+}) - m_{\pi^+} = 547 \pm 4 \pm 3$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.NODE=M248DM1
NODE=M248DM1

NODE=M248DM1;LINKAGE=A

 $B_J(5970)^0$ MASSOUR FIT uses m_{B^+} and $m_{B_J(5970)^0} - m_{B^+}$ to determine $m_{B_J(5970)^0}$.

VALUE (MeV)

DOCUMENT ID

5971 ± 5 OUR FIT **$m_{B_J(5970)^0} - m_{B^+}$**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

691 ± 5 OUR FIT**691 ± 5 OUR AVERAGE**

689.9 ± 2.9 ± 5.1

10k

¹ AAIJ

15AB LHCB

 pp at 7, 8 TeV

698 ± 5 ± 12

2.6k

² AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

714.3 ± 6.4 ± 5.1

10k

³ AAIJ

15AB LHCB

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 550.4 \pm 2.9 \pm 5.1$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AALTONEN 14l reports $m_{B_J(5970)^0} - m_{B^+} - m_{\pi^-} = 558 \pm 5 \pm 12$ MeV which we adjusted by the π^- mass.³ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 575 \pm 6 \pm 5$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M248M0

NODE=M248M0
NODE=M248M0NODE=M248DM0
NODE=M248DM0

OCCUR=2

NODE=M248DM0;LINKAGE=B

NODE=M248DM0;LINKAGE=A

NODE=M248DM0;LINKAGE=C

$m_{B_J(5970)^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

691.6 ± 3.7 ± 5.1	10k	¹ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
		¹ AAIJ 15AB reports		$[m_{B_J^0} - m_{B^{*+}}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 552 \pm 4 \pm 5$ MeV

which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M248DM2
NODE=M248DM2

NODE=M248DM2;LINKAGE=A

 $B_J(5970)$ WIDTH

NODE=M248210

 $B_J(5970)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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62 ± 20 OUR AVERAGE

63 ± 15 ± 17	2k	¹ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
60 ⁺³⁰ ₋₂₀ ± 40	1.4k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

61 ± 14 ± 17	2k	² AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
61 ± 15 ± 17	2k	³ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV

¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M248W+
NODE=M248W+

OCCUR=2
OCCUR=3

NODE=M248W+;LINKAGE=A

NODE=M248W+;LINKAGE=B

NODE=M248W+;LINKAGE=C

 $B_J(5970)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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81 ± 12 OUR AVERAGE

82 ± 8 ± 9	10k	¹ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
70 ⁺³⁰ ₋₂₀ ± 30	2.6k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

56 ± 7 ± 9	10k	² AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV
82 ± 10 ± 9	10k	³ AAIJ	15AB LHCB	$p\bar{p}$ at 7, 8 TeV

¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M248W0
NODE=M248W0

OCCUR=2
OCCUR=3

NODE=M248W0;LINKAGE=A

NODE=M248W0;LINKAGE=B

NODE=M248W0;LINKAGE=C

 $B_J(5970)$ DECAY MODES

NODE=M248215;NODE=M248

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	possibly seen
Γ_2 $B^*\pi$	seen

DESIG=1
DESIG=2

 $B_J(5970)$ BRANCHING RATIOS

NODE=M248220

$\Gamma(B\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
--------------------------------------	-------	------	-------------	------	-----	---------	-------------------

possibly seen		2k	¹ AAIJ	15AB LHCB	±	$p\bar{p}$ at 7, 8 TeV	
possibly seen		10k	¹ AAIJ	15AB LHCB	0	$p\bar{p}$ at 7, 8 TeV	
possibly seen		2.6k	AALTONEN	14I CDF	0	$p\bar{p}$ at 1.96 TeV	
possibly seen		1.4k	AALTONEN	14I CDF	±	$p\bar{p}$ at 1.96 TeV	

¹ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.

NODE=M248R01
NODE=M248R01

OCCUR=2

OCCUR=2

NODE=M248R01;LINKAGE=A

$\Gamma(B^*\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ
--	-------	------	-------------	------	-----	---------	-------------------

seen		10k	AAIJ	15AB LHCB	0	$p\bar{p}$ at 7, 8 TeV	
seen		2k	AAIJ	15AB LHCB	±	$p\bar{p}$ at 7, 8 TeV	
seen		2.6k	AALTONEN	14I CDF	0	$p\bar{p}$ at 1.96 TeV	
seen		1.4k	AALTONEN	14I CDF	±	$p\bar{p}$ at 1.96 TeV	

NODE=M248R02
NODE=M248R02

OCCUR=2

OCCUR=2

 $B_J(5970)$ REFERENCES

NODE=M248

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)

REFID=56628
REFID=56029

BOTTOM, STRANGE MESONS

($B = \pm 1, S = \mp 1$)

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \text{ similarly for } B_s^{*\prime}s$$

$B_{s1}(5830)^0$

$$I(J^P) = 0(1^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=MXXX046

NODE=MXXX046

NODE=M187

NODE=M187

NODE=M187M

NODE=M187M

$B_{s1}(5830)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5828.73 ± 0.20 OUR FIT			
5828.65 ± 0.24 OUR AVERAGE			
5828.78 ± 0.09 ± 0.29	SIRUNYAN	18DF CMS	$p\bar{p}$ at 8 TeV
5828.40 ± 0.04 ± 0.41	¹ AAIJ	130 LHCb	$p\bar{p}$ at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5829.4 ± 0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Uses $B_{s1}(5830)^0 \rightarrow B^{*+} K^-$ decay.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M187M;LINKAGE=AI

NODE=M187M;LINKAGE=AA

$$m_{B_{s1}^0} - m_{B^{*+}}$$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
503.98 ± 0.17 OUR FIT			
504.03 ± 0.12 ± 0.15			
	¹ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
504.41 ± 0.21 ± 0.14	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ AALTONEN 14I reports $m_{B_{s1}(5830)^0} - m_{B^{*+}} - m_{K^-} = 10.35 \pm 0.12 \pm 0.15$ MeV which we adjusted by the K^- mass.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M187DM

NODE=M187DM

NODE=M187DM;LINKAGE=AL

NODE=M187DM;LINKAGE=AA

$B_{s1}(5830)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
0.5 ± 0.3 ± 0.3	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

NODE=M187W

NODE=M187W

$B_{s1}(5830)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*+} K^-$	seen
Γ_2 $B^{*0} K_S^0$	

NODE=M187215;NODE=M187

DESIG=1

DESIG=2

$B_{s1}(5830)^0$ BRANCHING RATIOS

$\Gamma(B^{*+} K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AALTONEN	08K CDF	$p\bar{p}$ at 1.96 TeV
$\Gamma(B^{*0} K_S^0)/\Gamma(B^{*+} K^-)$	Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.49 ± 0.12 ± 0.07	¹ SIRUNYAN	18DF CMS	$p\bar{p}$ at 8 TeV

NODE=M187220

NODE=M187R01

NODE=M187R01

NODE=M187R00

NODE=M187R00

¹ With the branching fractions $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$ and $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.

NODE=M187R00;LINKAGE=A

$B_{s1}(5830)^0$ REFERENCES

SIRUNYAN	18DF EPJ C78 939	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	130 PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	08K PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M187

REFID=59328
REFID=56029
REFID=54968
REFID=52235 **$B_{s2}^*(5840)^0$** $I(J^P) = 0(2^+)$
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M186

NODE=M186

 $B_{s2}^*(5840)^0$ MASS

NODE=M186M

NODE=M186M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5839.88±0.12 OUR FIT			
5839.92±0.14 OUR AVERAGE			
5839.86±0.09±0.17	SIRUNYAN	18DF CMS	pp at 8 TeV
5839.99±0.05±0.20	AAIJ	130 LHCb	pp at 7 TeV
5839.6 ±1.1 ±0.7	¹ ABAZOV	08E D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5839.7 ±0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Observed in $B_{s2}^{*0} \rightarrow B^+ K^-$. Measured production rate of B_{s2}^{*0} relative to B^+ to be $(1.15 \pm 0.23 \pm 0.13)\%$.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M186M;LINKAGE=AB

NODE=M186M;LINKAGE=AA

 $m_{B_{s2}^{*0}} - m_{B_{s1}^0}$

NODE=M186DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5±0.6	¹ AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			
$m_{B_{s2}^{*0}} - m_{B^+}$			

NODE=M186DM

NODE=M186DM;LINKAGE=AA

NODE=M186DM2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
560.48±0.12 OUR FIT			
560.41±0.13±0.14	¹ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
¹ AALTONEN 14I reports $m_{B_{s2}^*(5840)^0} - m_{B^+} - m_{K^-} = 66.73 \pm 0.13 \pm 0.14$ MeV which we adjusted by the K^- mass.			

NODE=M186DM2

NODE=M186DM2;LINKAGE=AL

 $B_{s2}^*(5840)^0$ WIDTH

NODE=M186W

NODE=M186W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1.49±0.27 OUR AVERAGE			
1.52±0.34±0.30	SIRUNYAN	18DF CMS	pp at 8 TeV
1.4 ±0.4 ±0.2	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
1.56±0.13±0.47	¹ AAIJ	130 LHCb	pp at 7 TeV
¹ Uses $B_{s2}^*(5840)^0 \rightarrow B^{*+} K^-$ decays.			

NODE=M186W;LINKAGE=AI

 $B_{s2}^*(5840)^0$ DECAY MODES

NODE=M186215;NODE=M186

Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M186

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+ K^-$	DEFINED AS 1
Γ_2 $B^{*+} K^-$	0.093±0.018
Γ_3 $B^0 K_S^0$	0.43 ±0.11
Γ_4 $B^{*0} K_S^0$	0.04 ±0.04

DESIG=1

DESIG=2

DESIG=4

DESIG=3

$B_{s2}^*(5840)^0$ BRANCHING RATIOS $\Gamma(B^+ K^-)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AALTONEN	08K	CDF $p\bar{p}$ at 1.96 TeV
seen	¹ ABAZOV	08E	D0 $p\bar{p}$ at 1.96 TeV

¹ Measured production rate of B_{s2}^{*0} relative to B^+ to be $(1.15 \pm 0.23 \pm 0.13)\%$.

NODE=M186220

NODE=M186R01
NODE=M186R01

NODE=M186R01;LINKAGE=AB

 $\Gamma(B^{*+} K^-)/\Gamma(B^+ K^-)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.093 ± 0.013 ± 0.012	AAIJ	130	LHCB pp at 7 TeV

NODE=M186R02
NODE=M186R02 $\Gamma(B^{*0} K_S^0)/\Gamma(B^0 K_S^0)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.093 ± 0.086 ± 0.014	¹ SIRUNYAN	18DF	CMS pp at 8 TeV

NODE=M186R00
NODE=M186R00

¹ With the branching fraction $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.

NODE=M186R00;LINKAGE=A

 $\Gamma(B^0 K_S^0)/\Gamma(B^+ K^-)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.432 ± 0.077 ± 0.078	¹ SIRUNYAN	18DF	CMS pp at 8 TeV

NODE=M186R03
NODE=M186R03

¹ With the branching fractions $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$ and $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.

NODE=M186R03;LINKAGE=A

 $\Gamma(B^{*+} K^-)/\Gamma(B^+ K^-)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.081 ± 0.021 ± 0.015	¹ SIRUNYAN	18DF	CMS pp at 8 TeV

NODE=M186R04
NODE=M186R04

¹ With the branching fraction $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$.

NODE=M186R04;LINKAGE=A

 $B_{s2}^*(5840)^0$ REFERENCES

SIRUNYAN	18DF	EPJ C78 939	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)	REFID=59328
AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=56029
AAIJ	130	PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54968
AALTONEN	08K	PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=52235
ABAZOV	08E	PRL 100 082002	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=52232

NODE=M186

 $B_{sJ}^*(5850)$ $I(J^P) = ?(??)$

OMITTED FROM SUMMARY TABLE

Signal can be interpreted as coming from $\bar{b}s$ states. Needs confirmation.

NODE=M153

NODE=M153

 $B_{sJ}^*(5850)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5853 ± 15	141	AKERS	95E	OPAL $E_{\text{cm}}^{ee} = 88-94$ GeV

NODE=M153M

NODE=M153M

 $B_{sJ}^*(5850)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
47 ± 22	141	AKERS	95E	OPAL $E_{\text{cm}}^{ee} = 88-94$ GeV

NODE=M153W

NODE=M153W

 $B_{sJ}^*(5850)$ REFERENCES

AKERS	95E	ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)	REFID=44182
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NODE=M153

REFID=44182

$B_{sJ}(6063)^0$

$I(J^P) = 0(?^?)$

OMITTED FROM SUMMARY TABLE

 $B_{sJ}(6063)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
6063.5±1.2±0.8	¹ AAIJ	21D LHCB	pp at 7, 8, 13 TeV

¹Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb⁻¹.

NODE=M257

NODE=M257M

NODE=M257M

NODE=M257M;LINKAGE=A

 $B_{sJ}(6063)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
26±4±4	¹ AAIJ	21D LHCB	pp at 7, 8, 13 TeV

¹Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb⁻¹.

NODE=M257W

NODE=M257W

NODE=M257W;LINKAGE=A

 $B_{sJ}(6063)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+ K^-$	seen

NODE=M257215;NODE=M257

DESIG=1

 $B_{sJ}(6063)^0$ BRANCHING RATIOS

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	21D LHCB	$B^\pm K^\mp$ mass spectrum

NODE=M257225

NODE=M257R01

NODE=M257R01

 $B_{sJ}(6063)^0$ REFERENCES

AAIJ	21D EPJ C81 601	R. Aaij <i>et al.</i>	(LHCb Collab.)
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NODE=M257

REFID=61130

NODE=M258

 $B_{sJ}(6114)^0$

$I(J^P) = 0(?^?)$

OMITTED FROM SUMMARY TABLE

 $B_{sJ}(6114)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
6114±3±5	¹ AAIJ	21D LHCB	pp at 7, 8, 13 TeV

¹Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb⁻¹.

NODE=M258M

NODE=M258M

NODE=M258M;LINKAGE=A

 $B_{sJ}(6114)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
66±18±21	¹ AAIJ	21D LHCB	pp at 7, 8, 13 TeV

¹Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb⁻¹.

NODE=M258W

NODE=M258W

NODE=M258W;LINKAGE=B

 $B_{sJ}(6114)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+ K^-$	seen

NODE=M258215;NODE=M258

DESIG=1

 $B_{sJ}(6114)^0$ BRANCHING RATIOS

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	21D LHCB	$B^\pm K^\mp$ mass spectrum

NODE=M258225

NODE=M258R01

NODE=M258R01

$B_{sJ}(6114)^0$ REFERENCES

AAIJ

21D EPJ C81 601

R. Aaij *et al.*

(LHCb Collab.)

NODE=M258

REFID=61130

BOTTOM, CHARMED MESONS
($B = C = \pm 1$)

$$B_c^+ = c\bar{b}, B_c^- = \bar{c}b, \text{ similarly for } B_c^{*'}s$$

NODE=MXXX049

NODE=MXXX049

NODE=M217

 $B_c(2S)^\pm$

$$I(J^P) = 0(0^-)$$

Quantum numbers neither measured nor confirmed.

NODE=M217

 $B_c(2S)^\pm$ MASS

NODE=M217M

NODE=M217M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
6871.2\pm1.0 OUR AVERAGE				
6871.7 \pm 1.3 \pm 0.3	24	^{1,2} AAIJ	19Y LHCB	pp at 7, 8, 13 TeV
6870.6 \pm 1.4 \pm 0.3	51	^{3,4} SIRUNYAN	19M CMS	pp at 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		⁵ AAIJ	18AL LHCB	pp at 8 TeV
6842 $\pm 4 \pm 5$	57	^{6,7} AAD	14AQ ATLS	pp at 7, 8 TeV

SYCLP=A

SYCLP=A

¹ AAIJ 19Y observed $B_c(2S)^+$ in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 2.2 (3.2) global (local) standard deviations significance.

NODE=M217M;LINKAGE=E

² AAIJ 19Y reports mass difference measurement of $M(B_c(2S)^+) - M(B_c^+) = 597.2 \pm 1.3 \pm 0.1$ MeV. We have adjusted this measurement with our best value of $M(B_c^+) = 6274.47 \pm 0.32$ MeV. The first uncertainty of the $M(B_c(2S)^+)$ value is a total of uncertainties reported by the experiment and the second one comes from our best value of $M(B_c^+)$.

NODE=M217M;LINKAGE=F

³ SIRUNYAN 19M observed $B_c(2S)^+$ in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 6.5 standard deviations significance.

NODE=M217M;LINKAGE=B

⁴ SIRUNYAN 19M reports mass difference measurement of $M(B_c(2S)^+) - M(B_c^+) = 596.1 \pm 1.2 \pm 0.8$ MeV. We have adjusted this measurement with our best value of $M(B_c^+) = 6274.47 \pm 0.32$ MeV. The first uncertainty of the $M(B_c(2S)^+)$ value is a total of uncertainties reported by the experiment and the second one comes from our best value of $M(B_c^+)$.

NODE=M217M;LINKAGE=D

⁵ AAIJ 18AL reports an upper limit on the ratio of production cross sections for $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04-0.09$ at 95% CL for the mass value reported by AAD 14AQ.

NODE=M217M;LINKAGE=A

⁶ Observed in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 5.2 standard deviations significance.

NODE=M217M;LINKAGE=AA

⁷ Might be the $B_c^*(2S)$.

NODE=M217M;LINKAGE=C

 $B_c(2S)^\pm$ DECAY MODES $\times B(\bar{b} \rightarrow B_c(2S))$

NODE=M217215;NODE=M217

The following quantities are not pure branching ratios; rather the fractions $\Gamma_i/\Gamma \times B(\bar{b} \rightarrow B_c(2S))$.

NODE=M217

Mode	Fraction (Γ_i/Γ)
Γ_1 $B_c^+ \pi^+ \pi^-$	seen

DESIG=1

$B_c(2S)^\pm$ BRANCHING RATIOS

NODE=M217225

$$\frac{\Gamma(B_c^+ \pi^+ \pi^-)}{\Gamma_{\text{total}}} \quad \Gamma_1/\Gamma$$

NODE=M217R01
NODE=M217R01

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen		SIRUNYAN	19M CMS	pp at 13 TeV
seen	57	¹ AAD	14AQ ATLS	pp at 7, 8 TeV
not seen		² AAIJ	18AL LHCb	pp at 8 TeV

¹ Observed with 5.2 standard deviations significance.

² AAIJ 18AL reports an upper limit on the ratio of production cross sections for $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04-0.09$ at 95% CL for the mass value reported by AAD 14AQ.

NODE=M217R01;LINKAGE=AA
NODE=M217R01;LINKAGE=A

$B_c(2S)^\pm$ REFERENCES

NODE=M217

AAIJ	19Y	PRL 122 232001	R. Aaij <i>et al.</i>	(LHCb Collab.)
SIRUNYAN	19M	PRL 122 132001	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	18AL	JHEP 1801 138	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	14AQ	PRL 113 212004	G. Aad <i>et al.</i>	(ATLAS Collab.)

REFID=59795
REFID=59639
REFID=59246
REFID=56117

See the related review(s):

[Spectroscopy of Mesons Containing Two Heavy Quarks](#)

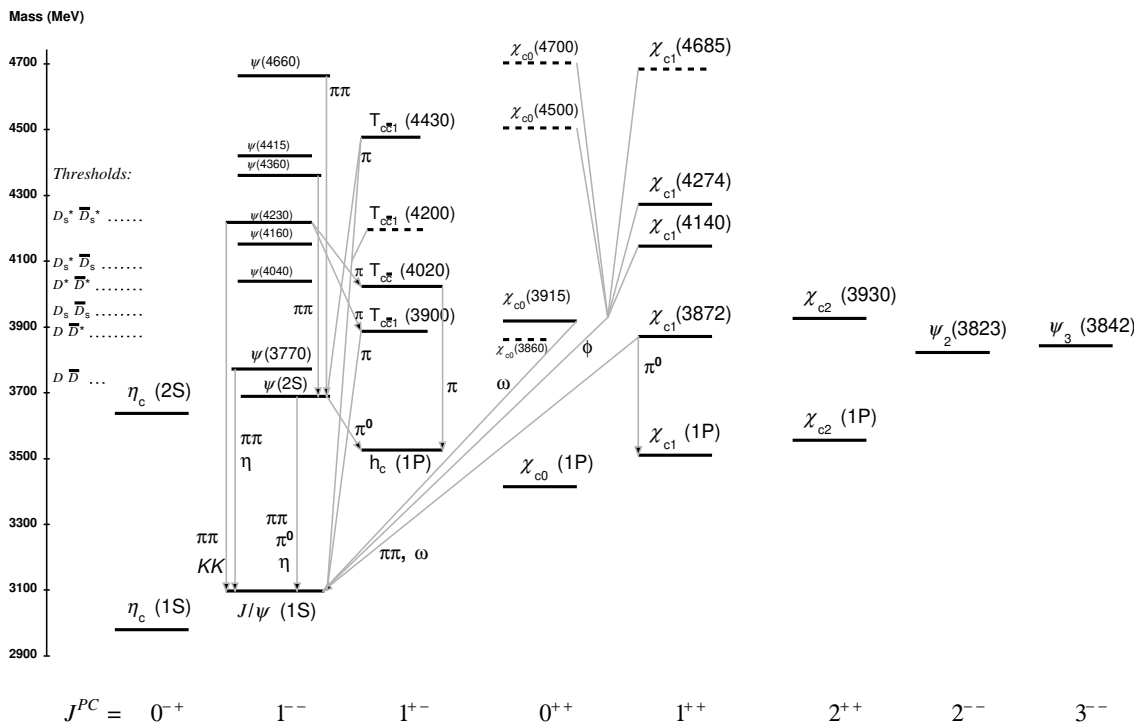
$c\bar{c}$ MESONS

(including possibly non- $q\bar{q}$ states)

NODE=MXXX025

NODE=M826

Updated March 2024.



The level scheme of meson states containing a minimal quark content of $c\bar{c}$ and having $S = C = B = 0$. The name of a state is determined by its quantum numbers $I^G J^{PC}$ (see the review “Naming Scheme for Hadrons”). States included

in the Summary Tables are shown with solid lines; selected states not in the Summary Tables, but with assigned quantum numbers, are shown with dotted lines. The arrows indicate the most dominant hadronic transitions. Single photon transitions, including $\psi(nS) \rightarrow \gamma\eta_c(mS)$, $\psi(nS) \rightarrow \gamma\chi_{cJ}(1P)$, and $\chi_{cJ}(1P) \rightarrow \gamma J/\psi$, are omitted for clarity. For orientation, the location of the thresholds related to a pair of ground state open charm mesons is indicated in the figure. The J^P of $T_{c\bar{c}}(4020)$ is not established. Decays to open flavour final states are not shown in the figure.

$\eta_c(1S)$		$I^G(J^{PC}) = 0^+(0^{-+})$					NODE=M026
$\eta_c(1S)$ MASS							NODE=M026M
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT		NODE=M026M	
2984.1 ± 0.4 OUR AVERAGE							
Error includes scale factor of 1.2.							
2985.01 ± 0.17 ± 0.89	35k	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$			
2983.9 ± 0.7 ± 0.1		¹ AAIJ	20H LHCb	$p p \rightarrow b X \rightarrow p \bar{p} X$			
2985.9 ± 0.7 ± 2.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma \omega \omega$			
2984.6 ± 0.7 ± 2.2	2673	XU	18 BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$			
2986.7 ± 0.5 ± 0.9	11k	² AAIJ	17AD LHCb	$p p \rightarrow B^+ X \rightarrow p \bar{p} K^+ X$			
2982.8 ± 1.0 ± 0.5	6.4k	³ AAIJ	17BB LHCb	$p p \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$			
2982.2 ± 1.5 ± 0.1	2.0k	⁴ AAIJ	15BI LHCb	$p p \rightarrow \eta_c(1S) X$			
2983.5 ± 1.4 ^{+1.6} / _{-3.6}		⁵ ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma \eta_c$			
2979.8 ± 0.8 ± 3.5	4.5k	^{6,7} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^0$			
2984.1 ± 1.1 ± 2.1	900	^{6,7,8} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \eta$	OCCUR=2		
2984.3 ± 0.6 ± 0.6		^{9,10} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma \eta_c$			
2984.49 ± 1.16 ± 0.52	832	⁶ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons			
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$			
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$			
2985.4 ± 1.5 ^{+0.5} / _{-2.0}	920	¹⁰ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$			
2982.2 ± 0.4 ± 1.6	14k	¹¹ LEES	10 BABR	$10.6 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$			
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S) K^{(*)} \rightarrow K \bar{K} \pi K^{(*)}$			
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma \gamma \rightarrow \eta_c \rightarrow$ hadrons			
2970 ± 5 ± 6	501	¹² ABE	07 BELL	$e^+ e^- \rightarrow J/\psi(c\bar{c})$			
2971 ± 3 ⁺² / ₋₁	195	WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$			
2974 ± 7 ⁺² / ₋₁	20	WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$	OCCUR=2		
2981.8 ± 1.3 ± 1.5	592	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$			
2984.1 ± 2.1 ± 1.0	190	¹³ AMBROGIANI	03 E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma \gamma$			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●							
2982.5 ± 0.4 ± 1.4	12k	¹⁴ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$	OCCUR=2		
2982.2 ± 0.6		¹⁵ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$			
2982 ± 5	270	¹⁶ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$			
2982.5 ± 1.1 ± 0.9	2.5k	¹⁷ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$			
2977.5 ± 1.0 ± 1.2		^{15,18} BAI	03 BES	$J/\psi \rightarrow \gamma \eta_c$			
2979.6 ± 2.3 ± 1.6	180	¹⁹ FANG	03 BELL	$B \rightarrow \eta_c K$			
2976.3 ± 2.3 ± 1.2		^{15,20} BAI	00F BES	$J/\psi, \psi(2S) \rightarrow \gamma \eta_c$			

2976.6 ± 2.9 ± 1.3	140	^{15,21} BAI	00F	BES	$J/\psi \rightarrow \gamma \eta_c$	OCCUR=2
2980.4 ± 2.3 ± 0.6		²² BRANDENB...	00B	CLE2	$\gamma \gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$	
2975.8 ± 3.9 ± 1.2		²¹ BAI	99B	BES	Sup. by BAI 00F	
2999 ± 8	25	ABREU	98O	DLPH	$e^+ e^- \rightarrow e^+ e^- + \text{hadrons}$	
2988.3 + 3.3 - 3.1		ARMSTRONG	95F	E760	$\bar{p} p \rightarrow \gamma \gamma$	
2974.4 ± 1.9		^{15,23} BISELLO	91	DM2	$J/\psi \rightarrow \eta_c \gamma$	
2969 ± 4 ± 4	80	¹⁵ BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$	OCCUR=3
2956 ± 12 ± 12		¹⁵ BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$	
2982.6 + 2.7 - 2.3	12	BAGLIN	87B	SPEC	$\bar{p} p \rightarrow \gamma \gamma$	
2980.2 ± 1.6		^{15,23} BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$	
2984 ± 2.3 ± 4.0		¹⁵ GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$	
2976 ± 8		^{15,24} BALTRUSAIT..84	MRK3		$J/\psi \rightarrow 2\phi \gamma$	
2982 ± 8	18	²⁵ HIMEL	80B	MRK2	$e^+ e^-$	
2980 ± 9		²⁵ PARTRIDGE	80B	CBAL	$e^+ e^-$	
¹ AAIJ 20H report $m_{J/\psi} - m_{\eta_c(1S)} = 113.0 \pm 0.7 \pm 0.1$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.						NODE=M026M;LINKAGE=H
² AAIJ 17AD report $m_{J/\psi} - m_{\eta_c(1S)} = 110.2 \pm 0.5 \pm 0.9$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.						NODE=M026M;LINKAGE=F
³ From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.						NODE=M026M;LINKAGE=G
⁴ AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$ MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays. We have used current value of $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to arrive at the quoted $m_{\eta_c(1S)}$ result.						NODE=M026M;LINKAGE=D
⁵ Taking into account an asymmetric photon lineshape.						NODE=M026M;LINKAGE=E
⁶ With floating width.						NODE=M026M;LINKAGE=AL
⁷ Ignoring possible interference with the non-resonant 0^- amplitude.						NODE=M026M;LINKAGE=LS
⁸ Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.						NODE=M026M;LINKAGE=EL
⁹ From a simultaneous fit to six decay modes of the η_c .						NODE=M026M;LINKAGE=BL
¹⁰ Accounts for interference with non-resonant continuum.						NODE=M026M;LINKAGE=VA
¹¹ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.						NODE=M026M;LINKAGE=LE
¹² From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.						NODE=M026M;LINKAGE=EB
¹³ Using mass of $\psi(2S) = 3686.00$ MeV.						NODE=M026M;LINKAGE=BG
¹⁴ Not independent from the measurements reported by LEES 10.						NODE=M026M;LINKAGE=DE
¹⁵ MITCHELL 09 observes a significant asymmetry in the lineshapes of $\psi(2S) \rightarrow \gamma \eta_c$ and $J/\psi \rightarrow \gamma \eta_c$ transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in $\psi(2S)$ or J/ψ radiative decays.						NODE=M026M;LINKAGE=MI
¹⁶ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.						NODE=M026M;LINKAGE=AU
¹⁷ Superseded by LEES 10.						NODE=M026M;LINKAGE=UB
¹⁸ From a simultaneous fit of five decay modes of the η_c .						NODE=M026M;LINKAGE=AK
¹⁹ Superseded by VINOKUROVA 11.						NODE=M026M;LINKAGE=FA
²⁰ Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.						NODE=M026M;LINKAGE=KZ
²¹ Average of several decay modes. Using an η_c width of 13.2 MeV.						NODE=M026M;LINKAGE=C1
²² Superseded by ASNER 04.						NODE=M026M;LINKAGE=NN
²³ Average of several decay modes.						NODE=M026M;LINKAGE=A
²⁴ $\eta_c \rightarrow \phi\phi$.						NODE=M026M;LINKAGE=B
²⁵ Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.						NODE=M026M;LINKAGE=M

$\eta_c(1S)$ WIDTH

VALUE (MeV)	EVT5	DOCUMENT ID	TECN	COMMENT	NODE=M026W
30.5 ± 0.5 OUR FIT	Error includes scale factor of 1.2.				NODE=M026W
30.5 ± 0.5 OUR AVERAGE	Error includes scale factor of 1.1.				
29.7 ± 0.5 ± 0.2	35k	AAIJ	23AH	LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$	
33.8 ± 1.6 ± 4.1	1705	ABLIKIM	19AV	BES3 $J/\psi \rightarrow \gamma \omega$	
30.8 + 2.3 ± 2.9 - 2.2	2673	XU	18	BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$	
34.0 ± 1.9 ± 1.3	11k	AAIJ	17AD	LHCB $p p \rightarrow B^+ X \rightarrow p \bar{p} K^+ X$	
31.4 ± 3.5 ± 2.0	6.4k	¹ AAIJ	17BB	LHCB $p p \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$	
27.2 ± 3.1 + 5.4 - 2.6		² ANASHIN	14	KEDR $J/\psi \rightarrow \gamma \eta_c$	
25.2 ± 2.6 ± 2.4	4.5k	^{3,4} LEES	14E	BABR $\gamma \gamma \rightarrow K^+ K^- \pi^0$	

34.8 \pm 3.1 \pm 4.0	900	^{3,4,5} LEES	14E	BABR	$\gamma\gamma \rightarrow K^+ K^- \eta$	OCCUR=2
32.0 \pm 1.2 \pm 1.0		^{6,7} ABLIKIM	12F	BES3	$\psi(2S) \rightarrow \gamma\eta_c$	
36.4 \pm 3.2 \pm 1.7	832	³ ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons	
37.8 \pm $\begin{smallmatrix} 5.8 \\ 5.3 \end{smallmatrix}$ \pm 3.1	486	ZHANG	12A	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$	
36.2 \pm 2.8 \pm 3.0	11k	DEL-AMO-SA..	11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	
35.1 \pm 3.1 $\begin{smallmatrix} +1.0 \\ -1.6 \end{smallmatrix}$	920	⁷ VINOKUROVA	11	BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$	
31.7 \pm 1.2 \pm 0.8	14k	⁸ LEES	10	BABR	$\begin{smallmatrix} 10.6 e^+ e^- \rightarrow \\ e^+ e^- K_S^0 K^\pm \pi^\mp \end{smallmatrix}$	
36.3 \pm $\begin{smallmatrix} 3.7 \\ 3.6 \end{smallmatrix}$ \pm 4.4	0.9k	AUBERT	08AB	BABR	$B \rightarrow \eta_c(1S) K^(*) \rightarrow K \bar{K} \pi K^(*)$	
28.1 \pm 3.2 \pm 2.2	7.5k	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons	
48 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\frac{8}{7}$ \pm 5	195	WU	06	BELL	$B^+ \rightarrow \rho \bar{p} K^+$	
40 \pm 19 \pm 5	20	WU	06	BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$	OCCUR=2
24.8 \pm 3.4 \pm 3.5	592	ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$	
20.4 \pm $\begin{smallmatrix} 7.7 \\ 6.7 \end{smallmatrix}$ \pm 2.0	190	AMBROGIANI	03	E835	$\bar{p} p \rightarrow \eta_c \rightarrow \gamma\gamma$	
23.9 \pm $\begin{smallmatrix} 12.6 \\ -7.1 \end{smallmatrix}$		ARMSTRONG	95F	E760	$\bar{p} p \rightarrow \gamma\gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

32.1 \pm 1.1 \pm 1.3	12k	⁹ DEL-AMO-SA..	11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	OCCUR=2
34.3 \pm 2.3 \pm 0.9	2.5k	¹⁰ AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$	
17.0 \pm 3.7 \pm 7.4		¹¹ BAI	03	BES	$J/\psi \rightarrow \gamma\eta_c$	
29 \pm 8 \pm 6	180	¹² FANG	03	BELL	$B \rightarrow \eta_c K$	
11.0 \pm 8.1 \pm 4.1		¹³ BAI	00F	BES	$J/\psi \rightarrow \gamma\eta_c$ and $\psi(2S) \rightarrow \gamma\eta_c$	
27.0 \pm 5.8 \pm 1.4		¹⁴ BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$	
7.0 \pm $\begin{smallmatrix} 7.5 \\ 7.0 \end{smallmatrix}$	12	BAGLIN	87B	SPEC	$\bar{p} p \rightarrow \gamma\gamma$	
10.1 \pm $\begin{smallmatrix} 33.0 \\ -8.2 \end{smallmatrix}$	23	¹⁵ BALTRUSAIT..	86	MRK3	$J/\psi \rightarrow \gamma\rho\bar{p}$	
11.5 \pm 4.5		GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$	
< 40 90% CL	18	HIMEL	80B	MRK2	$e^+ e^-$	
< 20 90% CL		PARTRIDGE	80B	CBAL	$e^+ e^-$	

¹ From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.

² Taking into account an asymmetric photon lineshape.

³ With floating mass.

⁴ Ignoring possible interference with the non-resonant 0^- amplitude.

⁵ Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁶ From a simultaneous fit to six decay modes of the η_c .

⁷ Accounts for interference with non-resonant continuum.

⁸ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁹ Not independent from the measurements reported by LEES 10.

¹⁰ Superseded by LEES 10.

¹¹ From a simultaneous fit of five decay modes of the η_c .

¹² Superseded by VINOKUROVA 11.

¹³ From a fit to the 4-prong invariant mass in $\psi(2S) \rightarrow \gamma\eta_c$ and $J/\psi(1S) \rightarrow \gamma\eta_c$ decays.

¹⁴ Superseded by ASNER 04.

¹⁵ Positive and negative errors correspond to 90% confidence level.

NODE=M026W;LINKAGE=B
 NODE=M026W;LINKAGE=A
 NODE=M026W;LINKAGE=AL
 NODE=M026W;LINKAGE=LS
 NODE=M026W;LINKAGE=EL
 NODE=M026W;LINKAGE=BL
 NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=DE
 NODE=M026W;LINKAGE=UB
 NODE=M026W;LINKAGE=AK
 NODE=M026W;LINKAGE=FA
 NODE=M026W;LINKAGE=KZ
 NODE=M026W;LINKAGE=NN
 NODE=M026W;LINKAGE=L

$\eta_c(1S)$ DECAY MODES

NODE=M026215;NODE=M026

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
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Decays involving hadronic resonances

Γ_1	$\eta'(958) \pi \pi$	(2.0 \pm 0.4) %	S=1.4
Γ_2	$\eta'(958) K \bar{K}$	(1.73 \pm 0.35) %	
Γ_3	$\eta'(958) \eta \eta$	(3.4 \pm 0.6) $\times 10^{-3}$	
Γ_4	$\rho \rho$	(1.8 \pm 0.4) %	
Γ_5	$K^*(892)^0 K^- \pi^+ +$ c.c.	(1.8 \pm 0.5) %	
Γ_6	$K^*(892) \bar{K}^*(892)$	(7.0 \pm 1.2) $\times 10^{-3}$	
Γ_7	$K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.4 \pm 0.6) %	
Γ_8	$\phi K^+ K^-$	(3.3 $\begin{smallmatrix} +1.2 \\ -1.1 \end{smallmatrix}$) $\times 10^{-3}$	
Γ_9	$\phi \phi$	(1.8 \pm 0.4) $\times 10^{-3}$	S=2.3

NODE=M026;CLUMP=A
 DESIG=24
 DESIG=85
 DESIG=93
 DESIG=19
 DESIG=26
 DESIG=18
 DESIG=57
 DESIG=28
 DESIG=17

Γ ₁₀	$\phi 2(\pi^+ \pi^-)$	< 4	$\times 10^{-3}$	CL=90%	DESIG=58
Γ ₁₁	$a_0(980)\pi$	seen			DESIG=21
Γ ₁₂	$a_2(1320)\pi$	seen			DESIG=22
Γ ₁₃	$K^*(892)\bar{K} + \text{c.c.}$	< 1.28	%	CL=90%	DESIG=40
Γ ₁₄	$f_2(1270)\eta$	seen			DESIG=23
Γ ₁₅	$f_2(1270)\eta'$	seen			DESIG=92
Γ ₁₆	$\omega\omega$	(2.7 ± 0.9)	$\times 10^{-3}$	S=2.1	DESIG=20
Γ ₁₇	$\omega\phi$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=47
Γ ₁₈	$f_2(1270)f_2(1270)$	(1.08±0.27)	%		DESIG=46
Γ ₁₉	$f_2(1270)f_2'(1525)$	(9.7 ± 3.2)	$\times 10^{-3}$		DESIG=59
Γ ₂₀	$f_0(500)\eta$	seen			DESIG=86
Γ ₂₁	$f_0(500)\eta'$	seen			DESIG=87
Γ ₂₂	$f_0(980)\eta$	seen			DESIG=70
Γ ₂₃	$f_0(980)\eta'$	seen			DESIG=88
Γ ₂₄	$f_0(1500)\eta$	seen			DESIG=71
Γ ₂₅	$f_0(1710)\eta'$	seen			DESIG=90
Γ ₂₆	$f_0(2100)\eta'$	seen			DESIG=91
Γ ₂₇	$f_0(2200)\eta$	seen			DESIG=72
Γ ₂₈	$a_0(1320)\pi$	seen			DESIG=74
Γ ₂₉	$a_0(1450)\pi$	seen			DESIG=75
Γ ₃₀	$a_2(1700)\pi$	seen			DESIG=94
Γ ₃₁	$a_0(1710)\pi$	seen			DESIG=97
Γ ₃₂	$a_0(1950)\pi$	seen			DESIG=79
Γ ₃₃	$K_0^*(1430)\bar{K} + \text{c.c.}$	seen			DESIG=76
Γ ₃₄	$K_2^*(1430)\bar{K} + \text{c.c.}$	seen			DESIG=77
Γ ₃₅	$K_0^*(1950)\bar{K} + \text{c.c.}$	seen			DESIG=78
Γ ₃₆	$K_0^*(2600)\bar{K} + \text{c.c.}$	seen			DESIG=95

Decays into stable hadrons

Γ ₃₇	$K\bar{K}\pi$	(7.1 ± 0.4)	%	S=1.1	DESIG=14
Γ ₃₈	$K\bar{K}\eta$	(1.32±0.15)	%		DESIG=25
Γ ₃₉	$\eta\pi^+\pi^-$	(1.6 ± 0.4)	%		DESIG=16
Γ ₄₀	$\eta 2(\pi^+\pi^-)$	(4.3 ± 1.3)	%		DESIG=61
Γ ₄₁	$K^+K^-\pi^+\pi^-$	(8.3 ± 1.8)	$\times 10^{-3}$	S=1.9	DESIG=15
Γ ₄₂	$K^+K^-\pi^+\pi^-\pi^0$	(3.4 ± 0.6)	%		DESIG=60
Γ ₄₃	$K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.}$	(5.4 ± 1.5)	%		DESIG=62
Γ ₄₄	$K^+K^-2(\pi^+\pi^-)$	(8.4 ± 2.4)	$\times 10^{-3}$		DESIG=55
Γ ₄₅	$2(K^+K^-)$	(1.4 ± 0.4)	$\times 10^{-3}$	S=1.4	DESIG=27
Γ ₄₆	$\pi^+\pi^-\pi^0$	< 4	$\times 10^{-4}$	CL=90%	DESIG=81
Γ ₄₇	$\pi^+\pi^-\pi^0\pi^0$	(4.6 ± 1.0)	%		DESIG=63
Γ ₄₈	$2(\pi^+\pi^-)$	(9.6 ± 1.5)	$\times 10^{-3}$	S=1.4	DESIG=11
Γ ₄₉	$2(\pi^+\pi^-\pi^0)$	(15.9 ± 2.0)	%		DESIG=64
Γ ₅₀	$3(\pi^+\pi^-)$	(1.89±0.34)	%		DESIG=56
Γ ₅₁	$p\bar{p}$	(1.33±0.11)	$\times 10^{-3}$	S=1.1	DESIG=12
Γ ₅₂	$p\bar{p}\pi^0$	(3.4 ± 1.3)	$\times 10^{-3}$		DESIG=65
Γ ₅₃	$p\bar{p}\pi^+\pi^-$	(3.7 ± 0.5)	$\times 10^{-3}$		DESIG=13
Γ ₅₄	$\Lambda\bar{\Lambda}$	(1.10±0.28)	$\times 10^{-3}$	S=1.5	DESIG=45
Γ ₅₅	$K^+\bar{p}\Lambda + \text{c.c.}$	(2.5 ± 0.4)	$\times 10^{-3}$		DESIG=82
Γ ₅₆	$\bar{\Lambda}(1520)\Lambda + \text{c.c.}$	(3.0 ± 1.3)	$\times 10^{-3}$		DESIG=83
Γ ₅₇	$\Sigma^+\bar{\Sigma}^-$	(2.6 ± 0.5)	$\times 10^{-3}$		DESIG=66
Γ ₅₈	$\Xi^-\bar{\Xi}^+$	(1.07±0.24)	$\times 10^{-3}$		DESIG=67

Radiative decays

Γ ₅₉	$\gamma\gamma$	(1.66±0.13)	$\times 10^{-4}$	S=1.2	DESIG=31
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**Charge conjugation (C), Parity (P),
Lepton Family number (LF) violating modes**

Γ ₆₀	$\pi^+\pi^-$	P, CP	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=51
Γ ₆₁	$\pi^0\pi^0$	P, CP	< 4	$\times 10^{-5}$	CL=90%	DESIG=52
Γ ₆₂	K^+K^-	P, CP	< 7	$\times 10^{-4}$	CL=90%	DESIG=53
Γ ₆₃	$K_S^0K_S^0$	P, CP	< 4	$\times 10^{-4}$	CL=90%	DESIG=54

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and B^\pm with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_6	14									
x_9	11	13								
x_{16}	7	8	8							
x_{18}	9	11	11	7						
x_{37}	25	25	22	12	17					
x_{38}	13	13	11	6	9	51				
x_{41}	7	7	6	4	5	15	8			
x_{45}	5	5	5	2	3	12	6	4		
x_{48}	13	17	17	10	15	26	13	8	5	
x_{51}	19	20	20	11	16	39	20	11	11	24
x_{53}	7	7	8	4	5	22	11	5	10	8
x_{54}	5	7	7	4	6	12	6	3	4	10
x_{59}	-38	-35	-27	-16	-22	-63	-32	-17	-12	-31
Γ	-1	-1	-1	0	-1	-2	-1	0	0	-1
	x_1	x_6	x_9	x_{16}	x_{18}	x_{37}	x_{38}	x_{41}	x_{45}	x_{48}
x_{53}	21									
x_{54}	13	9								
x_{59}	-47	-17	-11							
Γ	1	0	0	-20						
	x_{51}	x_{53}	x_{54}	x_{59}						

$\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

$\Gamma(\gamma\gamma)$

Γ_{59}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.1 ± 0.4 OUR FIT				Error includes scale factor of 1.2.
••• We do not use the following data for averages, fits, limits, etc. •••				
5.8 ± 1.1	486	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
5.2 ± 1.2	273 ± 43	^{2,3} AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_c \bar{c}$
5.5 ± 1.2 ± 1.8	157 ± 33	⁴ KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$
7.4 ± 0.4 ± 2.3		⁵ ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$
13.9 ± 2.0 ± 3.0	41	⁶ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 ⁺ _{-1.0} 1.1 ⁺ _{-1.0} 1.9	190	⁷ AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6 ± 0.8 ± 2.3		^{5,8} BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
6.9 ± 1.7 ± 2.1	76	⁹ ACCIARRI	99T L3	$e^+e^- \rightarrow e^+e^-\eta_c$
27 ± 16 ± 10	5	⁵ SHIRAI	98 AMY	58 e^+e^-
6.7 ⁺ _{-1.7} 2.4 ± 2.3		⁴ ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
11.3 ± 4.2		¹⁰ ALBRECHT	94H ARG	$e^+e^- \rightarrow e^+e^-\eta_c$
8.0 ± 2.3 ± 2.4	17	¹¹ ADRIANI	93N L3	$e^+e^- \rightarrow e^+e^-\eta_c$
5.9 ⁺ _{-1.8} 2.1 ± 1.9		⁷ CHEN	90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$
6.4 ⁺ _{-3.4} 5.0 ± 2.4		¹² AIHARA	88D TPC	$e^+e^- \rightarrow e^+e^-X$
4.3 ⁺ _{-3.7} 3.4 ± 2.4		⁴ BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
28 ± 15		^{5,13} BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

NODE=M026W1
NODE=M026W1

- ¹ Assuming there is no interference with the non-resonant background.
² Calculated by us using $\Gamma(\eta_c \rightarrow K\bar{K}\pi) \times \Gamma(\eta_c \rightarrow \gamma\gamma) / \Gamma = 0.44 \pm 0.05$ keV from PDG 06 and $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.
³ Systematic errors not evaluated.
⁴ Normalized to $B(\eta_c \rightarrow p\bar{p}) = (1.3 \pm 0.4) \times 10^{-3}$.
⁵ Normalized to $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$.
⁶ Average of $K_S^0 K^\pm \pi^\mp$, $\pi^+ \pi^- K^+ K^-$, and $2(K^+ K^-)$ decay modes.
⁷ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
⁸ Superseded by ASNER 04.
⁹ Normalized to the sum of 9 branching ratios.
¹⁰ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow \phi\phi)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
¹¹ Superseded by ACCIARRI 99T.
¹² Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow 2K^+ 2K^-)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
¹³ Re-evaluated by AIHARA 88D.

NODE=M026W1;LINKAGE=ZH
 NODE=M026W1;LINKAGE=AU
 NODE=M026W1;LINKAGE=NS
 NODE=M026W1;LINKAGE=N3
 NODE=M026W1;LINKAGE=N2
 NODE=M026W;LINKAGE=FF
 NODE=M026W1;LINKAGE=N6
 NODE=M026W1;LINKAGE=NN
 NODE=M026W1;LINKAGE=N1
 NODE=M026W1;LINKAGE=N5
 NODE=M026W1;LINKAGE=WD
 NODE=M026W1;LINKAGE=N4
 NODE=M026W1;LINKAGE=A

$\eta_c(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M026220

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{59}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

102 ± 18 OUR FIT Error includes scale factor of 1.5.

98.1 ± 3.9 ± 11.7 2673 XU 18 BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$75.8^{+6.3}_{-6.2} \pm 8.4$ 486 ¹ ZHANG 12A BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

¹ Superseded by XU 18.

NODE=M026G10
 NODE=M026G10

NODE=M026G10;LINKAGE=A

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_{59}/\Gamma$

VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<39 90 < 1556 UEHARA 08 BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G09
 NODE=M026G09

$\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_{59}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

35 ± 6 OUR FIT

32.4 ± 4.2 ± 5.8 882 ± 115 UEHARA 08 BELL $\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G08
 NODE=M026G08

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_9\Gamma_{59}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

9.2 ± 2.2 OUR FIT Error includes scale factor of 2.7.

7.75 ± 0.66 ± 0.62 386 ± 31 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$6.8 \pm 1.2 \pm 1.3$ 132 ± 23 UEHARA 08 BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$

¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

NODE=M026G07
 NODE=M026G07

NODE=M026G07;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_{59}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

13 ± 5 OUR FIT Error includes scale factor of 2.2.

8.67 ± 2.86 ± 0.96 85 ± 29 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^- \pi^0)$

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M026G03
 NODE=M026G03

NODE=M026G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_{59}/\Gamma$

VALUE (eV) CL% DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.49 90 ¹ LIU 12B BELL $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M026G04
 NODE=M026G04

NODE=M026G04;LINKAGE=LI

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_{59}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

55 ± 14 OUR FIT

69 ± 17 ± 12 3182 ± 766 UEHARA 08 BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G19
 NODE=M026G19

$$\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 9 ± 13	1128 ± 206	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G20
NODE=M026G20

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{37}\Gamma_{59}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.360 ± 0.022 OUR FIT	Error includes scale factor of 1.5.			
0.396 ± 0.016 OUR AVERAGE				

NODE=M026G14
NODE=M026G14

0.386 ± 0.008 ± 0.021	12k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
0.374 ± 0.009 ± 0.031	14k	¹ LEES	10 BABR	$10.6 \frac{e^+ e^-}{e^+ e^-} K_S^0 K^\pm \pi^\mp$
0.407 ± 0.022 ± 0.028		^{2,3} ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$
0.60 ± 0.12 ± 0.09	41	^{3,4} ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1.47 ± 0.87 ± 0.27		³ SHIRAI	98 AMY	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
0.84 ± 0.21		³ ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^\pm K_S^0 \pi^\mp$
0.60 ^{+0.23} _{-0.20}		³ CHEN	90B CLEO	$\gamma\gamma \rightarrow \eta_c K^\pm K_S^0 \pi^\mp$
1.06 ± 0.41 ± 0.27	11	³ BRAUNSCH...	89 TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$
1.5 ^{+0.60} _{-0.45} ± 0.3	7	³ BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.418 ± 0.044 ± 0.022		^{3,5} BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
<0.63	95	³ BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
<4.4	95	ALTHOFF	85B TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ From the corrected and unfolded mass spectrum.

² Calculated by us from the value reported in ASNER 04 that assumes $B(\eta_c \rightarrow K\bar{K}\pi) = 5.5 \pm 1.7\%$

³ We have multiplied $K^\pm K_S^0 \pi^\mp$ measurement by 3 to obtain $K\bar{K}\pi$.

⁴ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

⁵ Superseded by ASNER 04.

NODE=M026G14;LINKAGE=LE
NODE=M026G14;LINKAGE=AA

NODE=M026G14;LINKAGE=C
NODE=M026G;LINKAGE=BB

NODE=M026G14;LINKAGE=NN

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
42 ± 9 OUR FIT	Error includes scale factor of 2.1.			
27 ± 6 OUR AVERAGE				

NODE=M026G15
NODE=M026G15

25.7 ± 3.2 ± 4.9	2019 ± 248	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$
280 ± 100 ± 60	42	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$
170 ± 80 ± 20	13.9 ± 6.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow \pi^+ \pi^- K^+ K^-) = (2.0 \pm 0.7)\%$.

NODE=M026G;LINKAGE=CC

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_{59}/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.190 ± 0.006 ± 0.028	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M026G02
NODE=M026G02

$$\Gamma(2(K^+ K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.2 ± 2.1 OUR FIT	Error includes scale factor of 1.5.			
5.8 ± 1.9 OUR AVERAGE				

NODE=M026G27
NODE=M026G27

5.6 ± 1.1 ± 1.6	216 ± 42	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+ K^-)$
350 ± 90 ± 60	46	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow 2(K^+ K^-)$
231 ± 90 ± 23	9.1 ± 3.3	² ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(K^+ K^-)$

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow) 2(K^+ K^-) = (2.1 \pm 1.2)\%$.

NODE=M026G;LINKAGE=DD

² Includes all topological modes except $\eta_c \rightarrow \phi\phi$.

NODE=M026G;LINKAGE=EE

$$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{48}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
48 ± 7 OUR FIT	Error includes scale factor of 1.5.			
42 ± 6 OUR AVERAGE				

NODE=M026G11
NODE=M026G11

40.7 ± 3.7 ± 5.3	5381 ± 492	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$
180 ± 70 ± 20	21.4 ± 8.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

$$\Gamma(\rho\bar{\rho}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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6.7 ± 0.6 OUR FIT Error includes scale factor of 1.1.

6.2 $^{+1.1}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.

7.20 ± 1.53 $^{+0.67}_{-0.75}$	157 ± 33	¹ KUO	05 BELL	$\gamma\gamma \rightarrow \rho\bar{\rho}$
4.6 $^{+1.3}_{-1.1}$ ± 0.4	190	AMBROGIANI	03 E835	$\bar{p}p \rightarrow \gamma\gamma$
8.1 $^{+2.9}_{-2.0}$		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$

¹ Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

NODE=M026G01
NODE=M026G01

NODE=M026G01;LINKAGE=GG

$\eta_c(1S)$ BRANCHING RATIOS

HADRONIC DECAYS

$$\Gamma(\eta'(958)K\bar{K})/\Gamma(\eta'(958)\pi\pi) \quad \Gamma_2/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.859 ± 0.052 ± 0.043 ¹ LEES 21A BABR $\gamma\gamma \rightarrow \eta' K^+ K^-$,
 $\eta' \pi^+ \pi^-$

¹ Based on Dalitz-plot analysis of the $\eta_c \rightarrow \eta' K^+ K^-$, $\eta' \pi^+ \pi^-$ final states where the fit fractions and relative phases are determined for numerous two-body intermediate states.

NODE=M026225

NODE=M026305

NODE=M026R55
NODE=M026R55

NODE=M026R55;LINKAGE=A

$$\Gamma(\eta'(958)\eta\eta)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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3.4 ± 0.5 ± 0.3 ¹ ABLIKIM 21C BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta\eta'$

¹ ABLIKIM 21C reports $[\Gamma(\eta_c(1S) \rightarrow \eta'(958)\eta\eta)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (4.86 \pm 0.62 \pm 0.45) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R63
NODE=M026R63

NODE=M026R63;LINKAGE=A

$$\Gamma(\rho\rho)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.1 ± 0.5 ± 0.1	72	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
2.3 ± 0.5 ± 0.2	113	^{2,3} BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^0\rho^0$
2.1 ± 1.0 ± 0.2	32	^{4,5} BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^+\rho^-$
<14	90	⁶ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$

¹ ABLIKIM 05L reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.6 \pm 0.6 \pm 0.4) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.30 \pm 0.30 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

⁴ BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.0 \pm 1.3 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

⁶ Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R9
NODE=M026R9

OCCUR=2

NODE=M026R9;LINKAGE=F

NODE=M026R9;LINKAGE=A

NODE=M026R9;LINKAGE=B

NODE=M026R9;LINKAGE=C

NODE=M026R9;LINKAGE=D

NODE=M026R9;LINKAGE=G

$$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.8 ± 0.4 ± 0.2 63 ¹ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c\gamma$

¹ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.6 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R16
NODE=M026R16

NODE=M026R16;LINKAGE=A

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M026R25
NODE=M026R25

• • • We do not use the following data for averages, fits, limits, etc. • • •

$135 \pm 57 \pm 13$	45	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow K^* \bar{K}^* \pi^+ \pi^- \gamma$
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¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R25;LINKAGE=AB

 $\Gamma(\phi K^+ K^-) / \Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M026R21
NODE=M026R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.9^{+0.9}_{-0.8} \pm 1.1$	$14.1^{+4.4}_{-3.7}$	¹ HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$
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¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R;LINKAGE=BB

 $\Gamma(\phi 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R26
NODE=M026R26

<40	90	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-) \gamma$
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¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow \phi 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] < 0.603 \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R26;LINKAGE=AB

 $\Gamma(a_0(980) \pi) / \Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R11
NODE=M026R11

seen		AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.02	90	^{1,2} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
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¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

² We are assuming $B(a_0(980) \rightarrow \eta \pi) > 0.5$.

NODE=M026R11;LINKAGE=E

NODE=M026R11;LINKAGE=F

 $\Gamma(a_2(1320) \pi) / \Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R12
NODE=M026R12

seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.02	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
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¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R12;LINKAGE=E

 $\Gamma(K^*(892) \bar{K} + c.c.) / \Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R17
NODE=M026R17

<0.0128	90	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
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<0.0132	90	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
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¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

OCCUR=2

NODE=M026R17;LINKAGE=E

 $\Gamma(f_2(1270) \eta) / \Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R13
NODE=M026R13

seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.011	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
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¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R13;LINKAGE=E

 $\Gamma(f_2(1270) \eta') / \Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M026R60
NODE=M026R60

seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta'$; $K^+ K^- \eta'$
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$\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{17}/Γ
$< 2.5 \times 10^{-4}$	90	¹ ABLIKIM	17P BES3	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$	NODE=M026R22 NODE=M026R22
$< 17 \times 10^{-4}$	90	² ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $B(J/\psi \rightarrow \gamma \eta_c) = 0.017 \pm 0.004$.

² The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R22;LINKAGE=A
NODE=M026R22;LINKAGE=E

 $\Gamma(f_0(500)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{20}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$	NODE=M026R57 NODE=M026R57

 $\Gamma(f_0(500)\eta')/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{21}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c(1S) \rightarrow \pi^+ \pi^- \eta'$	NODE=M026R58 NODE=M026R58

 $\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{22}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$	NODE=M026R41 NODE=M026R41
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$	

 $\Gamma(f_0(980)\eta')/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{23}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta'$, $K^+ K^- \eta'$	NODE=M026R56 NODE=M026R56

 $\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{24}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$	NODE=M026R42 NODE=M026R42
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$	

 $\Gamma(f_0(1710)\eta')/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{25}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta'$	NODE=M026R59 NODE=M026R59

 $\Gamma(f_0(2100)\eta')/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{26}/Γ
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$	NODE=M026R61 NODE=M026R61

 $\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{27}/Γ
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$	NODE=M026R43 NODE=M026R43

 $\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{28}/Γ
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$	NODE=M026R45 NODE=M026R45
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$	

 $\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{29}/Γ
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$	NODE=M026R46 NODE=M026R46
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$	
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$	

 $\Gamma(a_2(1700)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{30}/Γ
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$	NODE=M026P10 NODE=M026P10

 $\Gamma(a_0(1710)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{31}/Γ
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$	NODE=M026P13 NODE=M026P13
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta'$	

$\Gamma(a_0(1950)\pi)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		LEES	21A BABR	Dalitz anal. of $\eta_c(1S) \rightarrow \pi^+\pi^-\eta'$
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$

¹ From a model-independant partial wave analysis.

NODE=M026R00
NODE=M026R00

NODE=M026R00;LINKAGE=A

 $\Gamma(K_0^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta/\pi^0$

¹ From a model-independant partial wave analysis.

NODE=M026R47
NODE=M026R47

NODE=M026R47;LINKAGE=A

 $\Gamma(K_2^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta'$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\pi^0$

NODE=M026R48
NODE=M026R48

 $\Gamma(K_0^*(1950)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$
seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta'$
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta/\pi^0$

¹ From a Dalitz plot analysis using an isobar model.

NODE=M026R49
NODE=M026R49

NODE=M026R49;LINKAGE=A

 $\Gamma(K_0^*(2600)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K\pi)$

NODE=M026P11
NODE=M026P11

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
7.1 ± 0.4 OUR FIT				Error includes scale factor of 1.1.
7.4 ± 0.6 OUR AVERAGE				
6.9 ± 0.7 ± 0.6	146	¹ ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
7.8 ± 0.6 ± 0.6	267	² ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
6.1 ± 1.2 ± 0.6	55	^{3,4} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K^+K^-\pi^0$
7.6 ± 1.3 ± 0.8	107	^{5,6} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K_S^0 K^\mp\pi^\pm$
8.5 ± 1.8		⁷ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
4.7 ± 1.2 ± 0.5	0.6k	^{8,9} BAI	04 BES	$J/\psi \rightarrow \gamma K^\pm\pi^\mp K_S^0$
6.2 ± 1.7 ± 0.6	33	^{10,11} BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+K^-\pi^0$
4.9 ± 1.2 ± 0.5	68	^{12,13} BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\pm\pi^\mp K_S^0$
4.8 ± 1.7	95	^{14,15} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$
5.5 ± 2.1 ± 0.5	32	^{16,17} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^+K^-\pi^0$
4.0 ± 1.1 ± 0.4	63	^{18,19} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^\pm\pi^\mp K_S^0$
13 $\frac{+7}{-5}$ ± 2		²⁰ HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c\gamma$
< 10.7 90% CL		¹⁵ PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta_c\gamma$

NODE=M026R4
NODE=M026R4

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

NODE=M026R4;LINKAGE=C

NODE=M026R4;LINKAGE=F

NODE=M026R4;LINKAGE=BK

NODE=M026R4;LINKAGE=CK

¹ ABLIKIM 19AP quotes $B(\eta_c \rightarrow K^+K^-\pi^0) = (1.15 \pm 0.12 \pm 0.10) \times 10^{-2}$ which we multiply by 6 to account for isospin symmetry.

² ABLIKIM 19AP quotes $B(\eta_c \rightarrow K_S^0 K^\pm\pi^\mp) = (2.60 \pm 0.21 \pm 0.20) \times 10^{-2}$ which we multiply by 3 to account for isospin symmetry.

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+K^-\pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

- ⁵ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry. NODE=M026R4;LINKAGE=BL
- ⁶ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values. NODE=M026R4;LINKAGE=CL
- ⁷ Determined from the ratio of $B(B^\pm \rightarrow K^\pm \eta_c) B(\eta_c \rightarrow K \bar{K} \pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$ reported in AUBERT, B 04B and $B(B^\pm \rightarrow K^\pm \eta_c) = (8.7 \pm 1.5) \times 10^{-3}$ reported in AUBERT 06E. NODE=M026R4;LINKAGE=AB
- ⁸ BAI 04 reports $B(J/\psi \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry. NODE=M026R4;LINKAGE=H
- ⁹ BAI 04 reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (6.6 \pm 0.9 \pm 1.5) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=I
- ¹⁰ BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (8.76 \pm 1.80 \pm 1.68) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=J
- ¹¹ BISELLO 91 reports $B(J/\psi \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry. NODE=M026R4;LINKAGE=M
- ¹² BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (6.9 \pm 1.2 \pm 1.2) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=L
- ¹³ BISELLO 91 reports $B(J/\psi \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry. NODE=M026R4;LINKAGE=N
- ¹⁴ Average from $K^+ K^- \pi^0$ and $K^\pm K_S^0 \pi^\mp$ decay channels. NODE=M026R4;LINKAGE=D
- ¹⁵ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages. NODE=M026R4;LINKAGE=E
- ¹⁶ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (7.8 \pm 3.0) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=Q
- ¹⁷ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.3 \pm 0.5) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry. NODE=M026R4;LINKAGE=S
- ¹⁸ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (5.7 \pm 1.5) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=R
- ¹⁹ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry. NODE=M026R4;LINKAGE=T
- ²⁰ HIMEL 80B reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \eta_c(1S))] = (4.5^{+2.4}_{-1.8}) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M026R4;LINKAGE=G

 $\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$ Γ_8/Γ_{37}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	7	1 HUANG	03	BELL $B^\pm \rightarrow K^\pm \phi \phi$

NODE=M026R02
NODE=M026R02

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R02;LINKAGE=BB

 $\Gamma(K \bar{K} \eta)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M026R15
NODE=M026R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.9 \pm 0.5 \pm 0.1$		7	^{1,2} ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
<3.1	90		³ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

OCCUR=2

- ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.
- ² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.
- ³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R15;LINKAGE=AK

NODE=M026R15;LINKAGE=AM

NODE=M026R15;LINKAGE=E

 $\Gamma(K \bar{K} \eta) / \Gamma(K \bar{K} \pi)$ $\Gamma_{38} / \Gamma_{37}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.186 ± 0.018 OUR FIT				
0.190 ± 0.008 ± 0.017	5.4k	¹ LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \eta / \pi^0$

NODE=M026R40
NODE=M026R40

- ¹ LEES 14E reports $B(\eta_c(1S) \rightarrow K^+ K^- \eta) / B(\eta_c(1S) \rightarrow K^+ K^- \pi^0) = 0.571 \pm 0.025 \pm 0.051$, which we divide by 3 to account for isospin symmetry. It uses both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

NODE=M026R40;LINKAGE=LE

 $\Gamma(\eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{39} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.6 ± 0.4 ± 0.2	33	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$
5.4 ± 2.0	75	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
3.7 ± 1.3 ± 2.0	18	² PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

NODE=M026R6
NODE=M026R6

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R6;LINKAGE=AB

- ² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

NODE=M026R6;LINKAGE=E

 $\Gamma(\eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_{40} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3 ± 1.2 ± 0.4	39	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$

NODE=M026R05
NODE=M026R05

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R05;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K \bar{K} \pi)$ $\Gamma_{42} / \Gamma_{37}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.477 ± 0.017 ± 0.070	11k	¹ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M026R01
NODE=M026R01

- ¹ We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma(K \bar{K} \pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026R01;LINKAGE=DE

 $\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{43} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4 ± 1.4 ± 0.5	43	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$

NODE=M026R06
NODE=M026R06

- ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^- \pi^- 2\pi^+) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.

NODE=M026R06;LINKAGE=AA

- ² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R06;LINKAGE=AB

$\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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8.4±2.4 OUR AVERAGE

8 ±4 ±1	10	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$
8.6±2.8±0.8	100	² ABLIKIM	06A BES2	$J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M026R23
NODE=M026R23

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R23;LINKAGE=AL

² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<4 × 10⁻⁴	90	¹ ABLIKIM	17AJ BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$
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NODE=M026R51
NODE=M026R51

¹ ABLIKIM 17AJ reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\eta_c(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 3.6 \times 10^{-3}$.

NODE=M026R51;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.6±0.9±0.5	118	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma\pi^+\pi^-\pi^0$
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NODE=M026R07
NODE=M026R07

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R07;LINKAGE=AB

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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15.9±2.0 OUR AVERAGE

15.3±1.8±1.8	333	ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
16.8±2.8±1.7	175	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+\pi^-\pi^0)$

NODE=M026R08
NODE=M026R08

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R08;LINKAGE=AB

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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18.9±3.4 OUR AVERAGE

20 ±5 ±2	51	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 3(\pi^+\pi^-)$
18 ±4 ±2	479	² ABLIKIM	06A BES2	$J/\psi \rightarrow 3(\pi^+\pi^-) \gamma$

NODE=M026R24
NODE=M026R24

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R24;LINKAGE=AL

² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.59 \pm 0.32 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R24;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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13.3± 1.1 OUR FIT	Error includes scale factor of 1.1.			
12.0± 2.6±1.5	34	ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$

NODE=M026R2
NODE=M026R2

• • • We do not use the following data for averages, fits, limits, etc. • • •

15 ± 5 ± 1	15	¹ ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p}$
12.9 ⁺ ₋ 1.8 ± 0.8	195	² WU	06	BELL	$B^+ \rightarrow p \bar{p} K^+$
13.5 ± 3.0 ± 1.3	213	³ BAI	04	BES	$J/\psi \rightarrow \gamma p \bar{p}$
9.2 ± 3.5 ± 0.9	18	⁴ BISELLO	91	DM2	$J/\psi \rightarrow \gamma p \bar{p}$
10 ± 5 ± 1	23	⁵ BALTRUSAITIS	.86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
22 ⁺ ₋ 22 ± 11		⁶ HIMEL	80B	MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R2;LINKAGE=AB

² WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=WU

³ BAI 04 reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.9 \pm 0.3 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=C

⁴ BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (0.13 \pm 0.04 \pm 0.03) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=D

⁵ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.4 \pm 0.7) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=F

⁶ HIMEL 80B reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \eta_c(1S))] = (8^{+8}_{-4}) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=G

$\Gamma(p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$

$\Gamma_{51}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

0.24 ± 0.07 OUR FIT Error includes scale factor of 1.9.

NODE=M026R33
NODE=M026R33

4.0⁺₋ 3.5
3.2

BAGLIN

89

SPEC

$\bar{p} p \rightarrow K^+ K^- K^+ K^-$

$\Gamma(p \bar{p} \pi^0)/\Gamma_{\text{total}}$

Γ_{52}/Γ

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.34 ± 0.12 ± 0.03 14 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p \bar{p} \pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R09;LINKAGE=AB

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$

Γ_{55}/Γ

VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

2.46⁺₋ 0.33 ± 0.16

157

¹ LU

19

BELL

$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M026R53
NODE=M026R53

¹ LU 19 reports $(2.83^{+0.36}_{-0.34} \pm 0.35) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$ assuming $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R53;LINKAGE=A

$\Gamma(\bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ± 1.3 ± 0.2	43	¹ LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$

NODE=M026R54
 NODE=M026R54

¹ LU 19 reports $(3.48 \pm 1.48 \pm 0.46) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \rightarrow \bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$ assuming $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R54;LINKAGE=A

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.4 ± 0.2	112	¹ ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma p \bar{p} \pi^0 \pi^0$

NODE=M026R28
 NODE=M026R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R28;LINKAGE=AB

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.07 ± 0.22 ± 0.10	78	¹ ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M026R29
 NODE=M026R29

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R29;LINKAGE=AB

————— **RADIATIVE DECAYS** —————

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.66 ± 0.13 OUR FIT					Error includes scale factor of 1.2.

NODE=M026310

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.2 ± 1.0 ± 0.3			¹ ABLIKIM	13i	BES3	
0.9 $^{+1.9}_{-0.8}$ ± 0.1	1.2 $^{+2.8}_{-1.1}$		² ADAMS	08	CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
2.0 $^{+0.9}_{-0.7}$ ± 0.1		13	³ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$
1.87 ± 0.32 $^{+0.95}_{-0.50}$			⁴ AMBROGIANI	03	E835	$\bar{p}p \rightarrow \gamma\gamma$
2.80 $^{+0.67}_{-0.58}$ ± 1.0			⁴ ARMSTRONG	95F	E760	$\bar{p}p \rightarrow \gamma\gamma$
< 9		90	⁵ BISELLO	91	DM2	$J/\psi \rightarrow \gamma\gamma\gamma$
6 $^{+4}_{-3}$ ± 4			⁴ BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma$
< 18		90	⁶ BLOOM	83	CBAL	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R31
 NODE=M026R31

¹ ABLIKIM 13i reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (4.5 \pm 1.2 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R31;LINKAGE=AL

² ADAMS 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.2 $^{+2.7}_{-1.1}$ ± 0.3) × 10⁻⁶ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.$

NODE=M026R31;LINKAGE=AD

³ WICHT 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (2.2 $^{+0.9+0.4}_{-0.7-0.2}$ × 10⁻⁷ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.$

NODE=M026R31;LINKAGE=WI

⁴ Not independent from the values of the total and two-photon width quoted by the same experiment.

NODE=M026R31;LINKAGE=AB

⁵ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=E

⁶ Using $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=C

$$\Gamma(\bar{p}p)/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \qquad \Gamma_{51}/\Gamma \times \Gamma_{59}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
0.221 ± 0.019 OUR FIT				Error includes scale factor of 1.2.
0.26 ± 0.05 OUR AVERAGE				Error includes scale factor of 1.4.
0.224 ^{+0.038} _{-0.037} ± 0.020	190	AMBROGIANI 03	E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
0.336 ^{+0.080} _{-0.070}		ARMSTRONG 95F	E760	$\bar{p}p \rightarrow \gamma\gamma$
0.68 ^{+0.42} _{-0.31}	12	BAGLIN 87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma$

NODE=M026R32
NODE=M026R32

————— Charge conjugation (C), Parity (P), —————
————— Lepton family number (LF) violating modes —————

NODE=M026320

$$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}} \qquad \Gamma_{60}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
••• We do not use the following data for averages, fits, limits, etc. •••				
<80	90	² ABLIKIM 06B	BES2	$J/\psi \rightarrow \pi^+\pi^-\gamma$
¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.82 \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				
² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				

NODE=M026R34
NODE=M026R34

NODE=M026R34;LINKAGE=AL

NODE=M026R34;LINKAGE=AB

$$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}} \qquad \Gamma_{61}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	90	¹ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$
••• We do not use the following data for averages, fits, limits, etc. •••				
<50	90	² ABLIKIM 06B	BES2	$J/\psi \rightarrow \pi^0\pi^0\gamma$
¹ ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				
² ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.71 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				

NODE=M026R35
NODE=M026R35

NODE=M026R35;LINKAGE=AL

NODE=M026R35;LINKAGE=AB

$$\Gamma(K^+K^-)/\Gamma_{\text{total}} \qquad \Gamma_{62}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<70	90	¹ ABLIKIM 06B	BES2	$J/\psi \rightarrow K^+K^-\gamma$
¹ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.96 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				

NODE=M026R36
NODE=M026R36

NODE=M026R36;LINKAGE=AB

$$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}} \qquad \Gamma_{63}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	¹ ABLIKIM 06B	BES2	$J/\psi \rightarrow K_S^0 K_S^0 \gamma$
••• We do not use the following data for averages, fits, limits, etc. •••				
<32	90	^{2,3} UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 5.6	90	^{4,5} UEHARA 13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
¹ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.53 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.				
² Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 1.6$ eV.				
³ Taking into account interference with the non-resonant continuum.				
⁴ Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 0.29$ eV.				
⁵ Neglecting interference with the non-resonant continuum.				

NODE=M026R37
NODE=M026R37

OCCUR=2

NODE=M026R37;LINKAGE=AB

NODE=M026R37;LINKAGE=A

NODE=M026R37;LINKAGE=U1

NODE=M026R37;LINKAGE=B

NODE=M026R37;LINKAGE=U2

$\eta_c(1S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M026230

$$\Gamma(\eta_c(1S) \rightarrow \eta'(958)\pi\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \qquad \Gamma_1/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.5 OUR FIT				Error includes scale factor of 1.4.
5.25 ± 1.65	14	¹ BALTRUSAITIS 86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R64
NODE=M026R64

¹ The value reported by BALTRUSAITIS 86 has been multiplied by 3/2 to account for isospin symmetry.

NODE=M026R64;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.6 OUR AVERAGE				Error includes scale factor of 1.2.
1.6 ± 0.6 ± 0.4	72	ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
3.30 ± 0.30 ± 0.60	113	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
3.0 ± 1.3 ± 0.6	32	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$

NODE=M026R65
NODE=M026R65

¹ The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

OCCUR=2
NODE=M026R65;LINKAGE=A

² The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

NODE=M026R65;LINKAGE=B

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.6	63	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R66
NODE=M026R66

$$\Gamma(\eta_c(1S) \rightarrow K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.99 ± 0.17 OUR FIT				
1.17 ± 0.29 OUR AVERAGE				
1.4 ± 0.3 ± 0.5	60	ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
1.04 ± 0.36 ± 0.18	14	¹ BISELLO	91 DM2	$e^+ e^- \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
1.2 ± 0.6	9	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R67
NODE=M026R67

¹ The reported value has been multiplied by 2 to account for isospin symmetry.

NODE=M026R67;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.91 ± 0.64 ± 0.48	45	ABLIKIM	06A BES2	$J/\psi \rightarrow K^{*0} \bar{K}^{*0} \pi^+ \pi^- \gamma$

NODE=M026R68
NODE=M026R68

$$\Gamma(\eta_c(1S) \rightarrow \phi K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.6^{+1.1}_{-0.9} ± 0.8	14.1 ^{+4.4} _{-3.7}	HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$

NODE=M026R69
NODE=M026R69

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.6 OUR FIT				Error includes scale factor of 2.2.
4.1 ± 0.6 OUR AVERAGE				Error includes scale factor of 1.2.

NODE=M026R80
NODE=M026R80

4.3 ± 0.5 ^{+0.5} _{-1.2}	1.2k	ABLIKIM	17P BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.3 ± 0.6 ± 0.6	72	ABLIKIM	05L BES2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.9 ± 0.9 ± 0.7	19	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.8 ^{+2.3} _{-1.5} ± 0.7	5	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
9.3 ± 2.0 ± 1.6	80	BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
8.5 ± 2.7 ± 1.8		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

OCCUR=2

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.3 ± 0.6 ± 0.6	357	¹ BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
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¹ Superseded by ABLIKIM 05L.

NODE=M026R80;LINKAGE=E

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0 ± 0.5 OUR FIT				Error includes scale factor of 2.2.

NODE=M026R70
NODE=M026R70

3.3^{+1.2}_{-1.0} OUR AVERAGE Error includes scale factor of 1.5.

4.7 ± 1.2 ± 0.5		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$
2.2 ^{+1.0} _{-0.7} ± 0.5	7	HUANG	03 BELL	$B^\pm \rightarrow K^\pm \phi\phi$

$$\Gamma(\eta_c(1S) \rightarrow \omega\omega)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.7 ±1.2 OUR FIT				Error includes scale factor of 2.1.
4.90±0.17±0.77	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma\omega\omega$

NODE=M026R71
NODE=M026R71

$$\Gamma(\eta_c(1S) \rightarrow f_2(1270) f_2(1270))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.5±0.4 OUR FIT				
1.3±0.3^{+0.3}_{-0.4}	91.2 ± 19.8	ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M026R72
NODE=M026R72

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.1 ±0.9 OUR FIT				Error includes scale factor of 1.5.
6.7 ±0.8 OUR AVERAGE				
6.6 ±0.9 ±1.5	0.6k	¹ BAI	04 BES	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
8.76 ±1.80 ±1.68	33	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
6.9 ±1.2 ±1.2	68	³ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
7.8 ±3.0	32	⁴ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
5.7 ±1.5	63	⁵ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$

NODE=M026R73
NODE=M026R73

¹ BAI 04 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R73;LINKAGE=A

² BISELLO 91 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

NODE=M026R73;LINKAGE=B

³ BISELLO 91 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R73;LINKAGE=C

⁴ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.3 \pm 0.5) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

NODE=M026R73;LINKAGE=D

⁵ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R73;LINKAGE=E

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
7.9 ±0.5 OUR FIT			Error includes scale factor of 1.1.
7.5 ±0.8 OUR AVERAGE			
8.01 ±0.42 ^{+1.71} _{-1.65}	¹ VINOKUROVA 11	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
7.4 ±0.5 ±0.7	AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm \eta_c$

NODE=M026R74
NODE=M026R74

¹ VINOKUROVA 11 reports $B(B^+ \rightarrow \eta_c K^+, \eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (26.7 \pm 1.4_{-2.6}^{+2.9} \pm 4.9) \times 10^{-6}$, where the first uncertainty is statistical, the second is due to systematics, and the third comes from interference of $\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$ with nonresonant $K_S^0 K^\pm \pi^\mp$. We combined both systematic uncertainties to single values. We multiply the reported result by 3 to account for isospin symmetry.

NODE=M026R74;LINKAGE=D

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{184}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.6±0.4 OUR FIT			Error includes scale factor of 1.3.
4.5^{+2.4}_{-1.8}	HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R75
NODE=M026R75

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.28±0.34 OUR FIT				
4.1 ±0.6 OUR AVERAGE				
3.7 ±0.7 ±0.3	55	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
4.6 ±0.8 ±0.3	107	^{3,4} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$

NODE=M026R76
NODE=M026R76

OCCUR=2

- ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.
- ² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.
- ⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \pi) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R76;LINKAGE=A

NODE=M026R76;LINKAGE=B

NODE=M026R76;LINKAGE=C

NODE=M026R76;LINKAGE=D

$$\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{38} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

NODE=M026R77
NODE=M026R77

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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7.9±1.0 OUR FIT

5.7±2.9±0.4	7	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
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- ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

NODE=M026R77;LINKAGE=A

- ² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R77;LINKAGE=B

$$\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{39} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

NODE=M026R78
NODE=M026R78

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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9.7±2.5±0.7	33	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$
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- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R78;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{39} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

NODE=M026R79
NODE=M026R79

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.2±0.9 OUR AVERAGE

4.6±1.1	75	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
3.1±1.1±1.5	18	PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

$$\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{40} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

NODE=M026R81
NODE=M026R81

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.6±0.7±0.2	39	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$
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- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R81;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{41} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

NODE=M026R84
NODE=M026R84

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.17±0.26 OUR FIT Error includes scale factor of 2.0.**1.9 ±0.6 OUR AVERAGE** Error includes scale factor of 2.4.

1.5 ±0.2 ±0.2	0.4k	BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
2.7 ±0.4	110	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{41} / \Gamma \times \Gamma_{184}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

NODE=M026R85
NODE=M026R85

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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3.0±0.8 OUR FIT Error includes scale factor of 1.7.

4.0^{+6.0}_{-2.5}	HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$
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$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{41} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma h_c(1P)$$

NODE=M026R83
NODE=M026R83

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT
5.0±1.0 OUR FIT Error includes scale factor of 1.7.
5.6±1.3±0.4 38 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^+ \pi^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R83;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{43} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma h_c(1P)$$

NODE=M026R86
NODE=M026R86

VALUE (units 10^{-2}) DOCUMENT ID TECN COMMENT
3.2±0.8±0.2 1,2 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^- \pi^- 2\pi^+) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.

NODE=M026R86;LINKAGE=A

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R86;LINKAGE=B

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{44} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma J/\psi(1S)$$

NODE=M026R88
NODE=M026R88

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
1.21±0.32±0.24 100 ABLIKIM 06A BES2 $J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{44} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma h_c(1P)$$

NODE=M026R87
NODE=M026R87

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT
4.8±2.5±0.3 10 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R87;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-)) / \Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+) / \Gamma_{\text{total}} \\ \Gamma_{45} / \Gamma \times \Gamma_{270}^{B^\pm} / \Gamma B^\pm$$

NODE=M026R90
NODE=M026R90

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
1.6±0.4 OUR FIT Error includes scale factor of 1.4.

1.8^{+0.6}_{-0.5} 14.5^{+4.6}_{-3.0} HUANG 03 BELL $B^+ \rightarrow 2(K^+ K^-) K^+$

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{45} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma h_c(1P)$$

NODE=M026R89
NODE=M026R89

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT
0.85±0.24 OUR FIT Error includes scale factor of 1.3.

1.3 ±0.5 ±0.1 7 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(K^+ K^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R89;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}} \\ \Gamma_{47} / \Gamma \times \Gamma_{30}^{h_c(1P)} / \Gamma h_c(1P)$$

NODE=M026R91
NODE=M026R91

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
2.7±0.5±0.2 118 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \pi^+ \pi^- 2\pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R91;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.35±0.19 OUR FIT Error includes scale factor of 1.3.

1.36±0.23 OUR AVERAGE

1.3 ±0.2 ±0.4	0.5k	BAI	04	BES	$J/\psi \rightarrow \gamma 2(\pi^+ \pi^-)$
1.33±0.22±0.20	137	BISELLO	91	DM2	$J/\psi \rightarrow \gamma 2(\pi^+ \pi^-)$
1.6 ±0.6	25	BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \gamma \eta_c$

NODE=M026R93
NODE=M026R93

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{184}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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3.4±0.7 OUR FIT Error includes scale factor of 1.3.

5.7^{+3.9}_{-2.4}

HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R94
NODE=M026R94

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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0.58±0.09 OUR FIT Error includes scale factor of 1.3. $[(0.57 \pm 0.09) \times 10^{-2}$ OUR 2024 FIT Scale factor = 1.3]

1.01±0.19±0.07 100 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+ \pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R92
NODE=M026R92

NEW

NODE=M026R92;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{49}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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10.1±1.7±0.7 175 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+ \pi^- \pi^0)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R95
NODE=M026R95

NODE=M026R95;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.59±0.32±0.47 471 ABLIKIM 06A BES2 $J/\psi \rightarrow 3(\pi^+ \pi^-) \gamma$

NODE=M026R97
NODE=M026R97

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.19±0.30±0.08 51 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 3(\pi^+ \pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R96
NODE=M026R96

NODE=M026R96;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \rho \bar{\rho})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{51}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.88±0.18 OUR FIT Error includes scale factor of 1.2.

1.61±0.29 OUR AVERAGE

1.9 ±0.3 ±0.3	213	BAI	04	BES	$J/\psi \rightarrow \gamma \rho \bar{\rho}$
1.3 ±0.4 ±0.3	18	BISELLO	91	DM2	$J/\psi \rightarrow \gamma \rho \bar{\rho}$
1.4 ±0.7	23	BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R99
NODE=M026R99

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

8.0±0.8 OUR FIT

8.7±2.9±0.6 15 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R98
NODE=M026R98

NODE=M026R98;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{184}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-6}) DOCUMENT ID TECN COMMENT

4.8±0.7 OUR FIT Error includes scale factor of 1.2.

8 +8
-4 HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026P00
NODE=M026P00

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

1.47±0.12 OUR FIT Error includes scale factor of 1.1.

1.54±0.19 OUR AVERAGE Error includes scale factor of 1.1.

$1.42 \pm 0.11^{+0.16}_{-0.20}$ 195 WU 06 BELL $B^+ \rightarrow p\bar{p}K^+$

$1.8^{+0.3}_{-0.2} \pm 0.2$ AUBERT,B 05L BABR $e^+e^- \rightarrow \Upsilon(4S)$

NODE=M026P01
NODE=M026P01

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{52}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

2.1±0.7±0.1 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026P02
NODE=M026P02

NODE=M026P02;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{53}/\Gamma \times \Gamma_{30}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

2.19±0.30 OUR FIT

3.1 ±1.0 ±0.2 19 1 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^+\pi^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026P07
NODE=M026P07

NODE=M026P07;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{53}/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-6}) DOCUMENT ID TECN COMMENT

4.0 ±0.4 OUR FIT

3.94 +0.41 +0.22
-0.39 -0.18 CHILIKIN 19 BELL $e^+e^- \rightarrow \Upsilon(4S)$

NODE=M026R82
NODE=M026R82

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{54}/\Gamma \times \Gamma_{245}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

1.5 ±0.4 OUR FIT Error includes scale factor of 1.5.

1.98±0.21±0.32 ABLIKIM 12B BES3 $J/\psi \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M026P03
NODE=M026P03

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{54}/\Gamma \times \Gamma_{270}^{B^\pm}/\Gamma_{B^\pm}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

1.21±0.30 OUR FIT Error includes scale factor of 1.5.

0.95 +0.25 +0.08
-0.22 -0.11 20 WU 06 BELL $B^+ \rightarrow \Lambda\bar{\Lambda}K^+$

NODE=M026P04
NODE=M026P04

$$\Gamma(\eta_c(1S) \rightarrow \Sigma^+ \bar{\Sigma}^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{57} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.60 \pm 0.48 \pm 0.31$	112	ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma p \bar{p}^0 \pi^0$

NODE=M026P05
NODE=M026P05

$$\Gamma(\eta_c(1S) \rightarrow \Xi^- \bar{\Xi}^+) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{58} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.51 \pm 0.27 \pm 0.14$	78	ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M026P06
NODE=M026P06

$$\Gamma(\eta_c(1S) \rightarrow \gamma \gamma) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{59} / \Gamma \times \Gamma_{245}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.34 ± 0.35 OUR FIT				Error includes scale factor of 1.2.

NODE=M026P08
NODE=M026P08

$3.8^{+1.3}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.

$4.5 \pm 1.2 \pm 0.6$		ABLIKIM	13I BES3	
$1.2^{+2.7}_{-1.1} \pm 0.3$	$1.2^{+2.8}_{-1.1}$	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

$$\Gamma(\eta_c(1S) \rightarrow \gamma \gamma) / \Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+) / \Gamma_{\text{total}}$$

$$\Gamma_{59} / \Gamma \times \Gamma_{270}^{B^\pm} / \Gamma_{B^\pm}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
0.183 ± 0.022 OUR FIT				Error includes scale factor of 1.2.
$0.22^{+0.09}_{-0.07} \pm 0.04$	13	WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$

NODE=M026P09
NODE=M026P09

$\eta_c(1S)$ REFERENCES

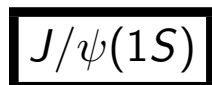
AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61030
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61442
AAIJ	20H	EPJ C80 191	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60419
ABLIKIM	19AP	PR D100 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59901
ABLIKIM	19AV	PR D100 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59998
CHILIKIN	19	PR D100 012001	K. Chilikin <i>et al.</i>	(BELLE Collab.)	REFID=59899
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)	REFID=59614
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE Collab.)	REFID=59453
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58322
ABLIKIM	17P	PR D95 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57989
LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57125
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57147
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56130
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937
ABLIKIM	13C	PR D87 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54878
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54954
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54267
ABLIKIM	12F	PRL 108 222002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54271
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54741
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)	REFID=54763
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53711
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
LEES	10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53236
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ABLIKIM	06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50987
ABLIKIM	06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50988
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50837
AUBERT,B	05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50827
KUO	05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)	REFID=50801
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
AUBERT,B	04B	PR D70 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50043
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
ABDALLAH	03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49625

NODE=M026

AMBROGIANI	03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
BAI	03	PL B555 174	J.Z. Bai <i>et al.</i>	(BES Collab.)
FANG	03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
BAI	00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRANDENB...	00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)
ACCIARRI	99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
SHIRAI	98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ALBRECHT	94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ADRIANI	93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
CHEN	90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BRAUNSCH...	89	ZPHY C41 533	W. Braunschweig <i>et al.</i>	(TASSO Collab.)
AIHARA	88D	PRL 60 2355	H. Aihara <i>et al.</i>	(TPC Collab.)
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BERGER	86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) JP
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)

REFID=49465
 REFID=49185
 REFID=49206
 REFID=49621
 REFID=49188
 REFID=48546
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 REFID=40018
 REFID=22009
 REFID=22010
 REFID=22012
 REFID=21349
 REFID=22006
 REFID=21682
 REFID=22003
 REFID=22004

NODE=M070



$$I^G(J^{PC}) = 0^-(1^{--})$$

J/psi(1S) MASS

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.900 ± 0.006 OUR AVERAGE				
3096.900 ± 0.002 ± 0.006		¹ ANASHIN 15	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ± 0.09	502	² ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ± 0.03 ± 0.01		³ ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
3096.95 ± 0.1 ± 0.3	193	BAGLIN 87	SPEC	$\bar{p}p \rightarrow e^+e^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3096.66 ± 0.19 ± 0.02	6.1k	⁴ AAIJ 15Bl	LHCB	$pp \rightarrow J/\psi X$
3096.917 ± 0.010 ± 0.007		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3097.5 ± 0.3		GRIBUSHIN 96	FMPS	$515 \pi^- \text{Be} \rightarrow 2\mu X$
3098.4 ± 2.0	38k	LEMOIGNE 82	GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3096.93 ± 0.09	502	⁵ ZHOLENTZ 80	REDE	e^+e^-
3097.0 ± 1		⁶ BRANDELIK 79c	DASP	e^+e^-

NODE=M070M

- ¹Supersedes AULCHENKO 03.
- ²Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).
- ³Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.
- ⁴From a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays. Systematic uncertainties not estimated.
- ⁵Superseded by ARTAMONOV 00.
- ⁶From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M070M;LINKAGE=A
 NODE=M070M;LINKAGE=AR
 NODE=M070M;LINKAGE=NW
 NODE=M070M;LINKAGE=B
 NODE=M070M;LINKAGE=RZ
 NODE=M070M;LINKAGE=F

J/psi(1S) WIDTH

NODE=M070W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
92.6 ± 1.7 OUR AVERAGE				
92.45 ± 1.40 ± 1.48		¹ ANASHIN 20	KEDR	e^+e^-
96.1 ± 3.2	13k	² ADAMS BAI	06A 95B	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
84.4 ± 8.9		BAI	BES	e^+e^-
91 ± 11 ± 6		³ ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
85.5 ^{+6.1} _{-5.8}		⁴ HSUEH 92	RVUE	See Υ mini-review

NODE=M070W

• • • We do not use the following data for averages, fits, limits, etc. • • •

92.94 ± 1.83		5,6 ANASHIN	18A KEDR	e^+e^-
94.1 ± 2.7		7 ANASHIN	10 KEDR	$3.097 e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
93.7 ± 3.5	7.8k	2 AUBERT	04 BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

¹ Based on the same dataset as ANASHIN 18A and correlated to the values reported there.

² Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(e^+e^-) = (5.94 \pm 0.06)\%$ and $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.

³ The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

⁴ Using data from COFFMAN 92, BALDINI-CELIO 75, BOYARSKI 75, ESPOSITO 75B, BRANDELIK 79C.

⁵ Using $\Gamma(e^+e^-)$ from ANASHIN 18A and $B(J/\psi(1S) \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ from PDG 16.

⁶ Superseded by ANASHIN 20 that is based on the same dataset.

⁷ Assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$ and using $\Gamma(e^+e^-)/\Gamma_{\text{total}} = (5.94 \pm 0.06)\%$.

NODE=M070W;LINKAGE=C
NODE=M070W;LINKAGE=AA

NODE=M070W;LINKAGE=AN
NODE=M070W;LINKAGE=A

NODE=M070W;LINKAGE=B

NODE=M070W;LINKAGE=D
NODE=M070W;LINKAGE=AS

J/ψ(1S) DECAY MODES

NODE=M070215;NODE=M070

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 hadrons	(87.7 ± 0.5) %		DESIG=3
Γ_2 virtual $\gamma \rightarrow$ hadrons	(13.46 ± 0.07) %		DESIG=4
Γ_3 ggg	(64.1 ± 1.0) %		DESIG=249
Γ_4 γgg	(8.8 ± 1.1) %		DESIG=250
Γ_5 e^+e^-	(5.971 ± 0.032) %		DESIG=1
Γ_6 $e^+e^-\gamma$	[a] (8.8 ± 1.4) × 10 ⁻³		DESIG=5
Γ_7 $\mu^+\mu^-$	(5.961 ± 0.033) %		DESIG=2
Γ_8 $e^+e^-e^+e^-$	(5.5 ± 0.5) × 10 ⁻⁵		DESIG=472
Γ_9 $e^+e^-\mu^+\mu^-$	(3.53 ± 0.26) × 10 ⁻⁵		DESIG=473
Γ_{10} $\mu^+\mu^-\mu^+\mu^-$	(1.11 ± 0.11) × 10 ⁻⁶		DESIG=471
Decays involving hadronic resonances			
Γ_{11} $\rho\pi$	(1.88 ± 0.12) %	S=2.6	NODE=M070;CLUMP=A DESIG=20
Γ_{12} $\rho^0\pi^0$	(6.2 ± 0.6) × 10 ⁻³		DESIG=21
Γ_{13} $a_2(1320)^0\pi^+\pi^- \rightarrow 2(\pi^+\pi^-)\pi^0$	(2.8 ± 0.6) × 10 ⁻³		DESIG=442
Γ_{14} $a_2(1320)^+\pi^-\pi^0 + \text{c.c.} \rightarrow 2(\pi^+\pi^-)\pi^0$	(3.7 ± 0.7) × 10 ⁻³		DESIG=443
Γ_{15} $a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Γ_{16} $\eta\pi^+\pi^-$	(3.8 ± 0.7) × 10 ⁻⁴		DESIG=239
Γ_{17} $\eta\rho$	(1.93 ± 0.23) × 10 ⁻⁴		DESIG=22
Γ_{18} $\eta\pi^+\pi^-\pi^0$	(1.17 ± 0.20) %		DESIG=420
Γ_{19} $\eta\pi^+\pi^-3\pi^0$	(4.9 ± 1.0) × 10 ⁻³		DESIG=422
Γ_{20} $\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$	(1.2 ± 0.4) × 10 ⁻⁴		DESIG=287
Γ_{21} $\eta\phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	DESIG=253
Γ_{22} $\eta K^+ K^-$	(8.6 ± 3.0) × 10 ⁻⁴		DESIG=455
Γ_{23} $\eta K^\pm K_S^0 \pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Γ_{24} $\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Γ_{25} $\rho\eta'(958)$	(8.1 ± 0.8) × 10 ⁻⁵	S=1.6	DESIG=23
Γ_{26} $\rho^\pm\pi^\mp\pi^+\pi^-2\pi^0$	(2.8 ± 0.8) %		DESIG=415
Γ_{27} $\rho^+\rho^-\pi^+\pi^-\pi^0$	(6 ± 4) × 10 ⁻³		DESIG=416
Γ_{28} $\rho^+ K^+ K^- \pi^- + \text{c.c.} \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 ± 0.8) × 10 ⁻³		DESIG=444
Γ_{29} $\rho^\mp K^\pm K_S^0$	(1.9 ± 0.4) × 10 ⁻³		DESIG=342
Γ_{30} $h_1(1415)\eta' \rightarrow \gamma\eta\eta'$			DESIG=435
Γ_{31} $h_1(1595)\eta' \rightarrow \gamma\eta\eta'$			DESIG=437
Γ_{32} $\rho(1450)\pi$	seen		DESIG=310;OUR EST;→ UNCHECKED ←
Γ_{33} $\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.2 ± 1.1) × 10 ⁻⁴		DESIG=328
Γ_{34} $\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp$	(3.3 ± 0.6) × 10 ⁻⁴		DESIG=329
Γ_{35} $\rho(1450)^0\pi^0 \rightarrow K^+ K^- \pi^0$	(2.7 ± 0.6) × 10 ⁻⁴		DESIG=312

Г36	$\rho(1450)\eta'(958) \rightarrow \pi^+\pi^-\eta'(958)$	$(3.3 \pm 0.7) \times 10^{-6}$		DESIG=345
Г37	$\rho(1700)\pi$	seen		DESIG=325;OUR EST;→ UNCHECKED ←
Г38	$\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0$	$(1.6 \pm 1.1) \times 10^{-4}$		DESIG=313
Г39	$\rho(2150)\pi$	seen		DESIG=326;OUR EST;→ UNCHECKED ←
Г40	$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	$(10 \pm 40) \times 10^{-6}$		DESIG=314
Г41	$\rho_3(1690)\pi \rightarrow \pi^+\pi^-\pi^0$			DESIG=316
Г42	$\omega\pi^0$	$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	DESIG=32
Г43	$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0$	$(1.6 \pm 0.7) \times 10^{-5}$		DESIG=327
Г44	$\omega\pi^+\pi^-$	$(8.5 \pm 1.0) \times 10^{-3}$	S=1.3	DESIG=24
Г45	$\omega\pi^0\pi^0$	$(3.4 \pm 0.8) \times 10^{-3}$		DESIG=140
Г46	$\omega 3\pi^0$	$(1.9 \pm 0.6) \times 10^{-3}$		DESIG=421
Г47	$\omega f_2(1270)$	$(4.3 \pm 0.6) \times 10^{-3}$		DESIG=28
Г48	$\omega\eta$	$(1.74 \pm 0.20) \times 10^{-3}$	S=1.6	DESIG=30
Г49	$\omega\pi^+\pi^-\pi^0$	$(4.0 \pm 0.7) \times 10^{-3}$		DESIG=211
Г50	$\omega\pi^0\eta$	$(3.4 \pm 1.7) \times 10^{-4}$		DESIG=360
Г51	$\omega\pi^+\pi^+\pi^-\pi^-$	$(8.5 \pm 3.4) \times 10^{-3}$		DESIG=26
Г52	$\omega\pi^+\pi^-2\pi^0$	$(3.3 \pm 0.5) \%$		DESIG=412
Г53	$\omega\eta'\pi^+\pi^-$	$(1.12 \pm 0.13) \times 10^{-3}$		DESIG=385
Г54	$\omega\eta'(958)$	$(1.89 \pm 0.18) \times 10^{-4}$		DESIG=31
Г55	$\omega f_0(980)$	$(1.4 \pm 0.5) \times 10^{-4}$		DESIG=150
Г56	$\omega f_0(1710) \rightarrow \omega K\bar{K}$	$(4.8 \pm 1.1) \times 10^{-4}$		DESIG=130
Г57	$\omega f_1(1420)$	$(6.8 \pm 2.4) \times 10^{-4}$		DESIG=105
Г58	$\omega f_2'(1525)$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=29
Г59	$\omega X(1835) \rightarrow \omega p\bar{p}$	$< 3.9 \times 10^{-6}$	CL=95%	DESIG=263
Г60	$\omega K^+K^-\eta$	$(3.33 \pm 0.12) \times 10^{-4}$		DESIG=478
Г61	$\omega X(1835), X \rightarrow \eta'\pi^+\pi^-$	$< 6.2 \times 10^{-5}$		DESIG=386
Г62	ωK^+K^-	$(1.52 \pm 0.31) \times 10^{-3}$		DESIG=441
Г63	$\omega K^\pm K_S^0 \pi^\mp$	[b] $(3.4 \pm 0.5) \times 10^{-3}$		DESIG=101
Г64	$\omega K\bar{K}$	$(1.9 \pm 0.4) \times 10^{-3}$		DESIG=27
Г65	$\omega K^*(892)\bar{K} + c.c.$	$(6.1 \pm 0.9) \times 10^{-3}$		DESIG=102
Г66	$\eta' K^{*\pm} K^\mp$	$(1.48 \pm 0.13) \times 10^{-3}$		DESIG=355
Г67	$\eta' K^{*0} \bar{K}^0 + c.c.$	$(1.66 \pm 0.21) \times 10^{-3}$		DESIG=357
Г68	$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + c.c.$	$(2.16 \pm 0.31) \times 10^{-4}$		DESIG=353
Г69	$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	$(1.51 \pm 0.23) \times 10^{-4}$		DESIG=354
Г70	$\eta' h_1(1415) \rightarrow \gamma\eta'\eta'$	$(4.7 \pm \frac{1.1}{2.0}) \times 10^{-7}$		DESIG=430
Г71	$\bar{K} K^*(892) + c.c.$	seen		DESIG=331;OUR EST;→ UNCHECKED ←
Г72	$\bar{K} K^*(892) + c.c. \rightarrow K_S^0 K^\pm \pi^\mp$	$(4.8 \pm 0.5) \times 10^{-3}$		DESIG=332
Г73	$K^+ K^*(892)^- + c.c.$	$(6.0 \pm \frac{0.8}{1.0}) \times 10^{-3}$	S=2.9	DESIG=121
Г74	$K^+ K^*(892)^- + c.c. \rightarrow K^+ K^-\pi^0$	$(2.69 \pm \frac{0.13}{0.20}) \times 10^{-3}$		DESIG=231
Г75	$K^+ K^*(892)^- + c.c. \rightarrow K^0 K^\pm \pi^\mp + c.c.$	$(3.0 \pm 0.4) \times 10^{-3}$		DESIG=232
Г76	$K^0 \bar{K}^*(892)^0 + c.c.$	$(4.2 \pm 0.4) \times 10^{-3}$		DESIG=122
Г77	$K^0 \bar{K}^*(892)^0 + c.c. \rightarrow K^0 K^\pm \pi^\mp + c.c.$	$(3.2 \pm 0.4) \times 10^{-3}$		DESIG=233
Г78	$\bar{K}^*(892)^0 K^+ \pi^- + c.c.$	$(5.7 \pm 0.8) \times 10^{-3}$		DESIG=214
Г79	$K^*(892)^\pm K^\mp \pi^0$	$(4.1 \pm 1.3) \times 10^{-3}$		DESIG=343
Г80	$K^*(892)^+ K_S^0 \pi^- + c.c.$	$(2.0 \pm 0.5) \times 10^{-3}$		DESIG=299
Г81	$K^*(892)^+ K_S^0 \pi^- + c.c. \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$	$(6.7 \pm 2.2) \times 10^{-4}$		DESIG=300
Г82	$K^*(892)^0 K^- \pi^+ + c.c. \rightarrow K^+ K^- \pi^+ \pi^-$	$(3.8 \pm 0.5) \times 10^{-3}$		DESIG=445
Г83	$K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(6.3 \pm \frac{0.6}{0.5}) \times 10^{-6}$		DESIG=376
Г84	$K^*(892)^0 K_S^0 \pi^0$	$(7 \pm 4) \times 10^{-4}$		DESIG=344
Г85	$K^*(892)^\pm K^*(700)^\mp$	$(1.1 \pm \frac{1.0}{0.6}) \times 10^{-3}$		DESIG=257

Γ_{86}	$K^*(892)^0 \bar{K}^*(892)^0$	$(2.3 \pm 0.6) \times 10^{-4}$		DESIG=46
Γ_{87}	$K^*(892)^\pm K^*(892)^\mp$	$(1.00 \pm_{-0.40}^{0.22}) \times 10^{-3}$		DESIG=256
Γ_{88}	$K_1(1400)^\pm K^\mp$	$(3.8 \pm 1.4) \times 10^{-3}$		DESIG=132
Γ_{89}	$K^*(1410) \bar{K} + c.c.$	seen		DESIG=317; OUR EST; \rightarrow UNCHECKED \leftarrow
Γ_{90}	$K^*(1410) \bar{K} + c.c. \rightarrow$ $K^\pm K^\mp \pi^0$	$(7 \pm 4) \times 10^{-5}$		DESIG=330
Γ_{91}	$K^*(1410) \bar{K} + c.c. \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$(8 \pm 5) \times 10^{-5}$		DESIG=318
Γ_{92}	$K_2^*(1430) \bar{K} + c.c.$	seen		DESIG=319; OUR EST; \rightarrow UNCHECKED \leftarrow
Γ_{93}	$K_2^*(1430) \bar{K} + c.c. \rightarrow$ $K^\pm K^\mp \pi^0$	$(1.0 \pm 0.5) \times 10^{-4}$		DESIG=321
Γ_{94}	$K_2^*(1430) \bar{K} + c.c. \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=320
Γ_{95}	$\bar{K}_2^*(1430) K + c.c.$	$< 4.0 \times 10^{-3}$	CL=90%	DESIG=45
Γ_{96}	$K_2^*(1430)^+ K^- + c.c. \rightarrow$ $K^+ K^- \pi^0$	$(2.69 \pm_{-0.19}^{0.25}) \times 10^{-4}$		DESIG=381
Γ_{97}	$K_2^*(1430)^0 K^- \pi^+ + c.c. \rightarrow$ $K^+ K^- \pi^+ \pi^-$	$(2.6 \pm 0.9) \times 10^{-3}$		DESIG=446
Γ_{98}	$K_2^*(1430)^+ K_S^0 \pi^- + c.c.$	$(3.6 \pm 1.8) \times 10^{-3}$		DESIG=301
Γ_{99}	$\bar{K}_2^*(1430)^0 K^*(892)^0 + c.c.$	$(4.67 \pm 0.29) \times 10^{-3}$		DESIG=48
Γ_{100}	$K_2^*(1430)^- K^*(892)^+ + c.c.$	$(3.4 \pm 2.9) \times 10^{-3}$		DESIG=303
Γ_{101}	$K_2^*(1430)^- K^*(892)^+ +$ $c.c. \rightarrow K^*(892)^+ K_S^0 \pi^- +$ $c.c.$	$(4 \pm 4) \times 10^{-4}$		DESIG=304
Γ_{102}	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90%	DESIG=47
Γ_{103}	$\bar{K}_2(1770)^0 K^*(892)^0 + c.c. \rightarrow$ $K^*(892)^0 K^- \pi^+ + c.c.$	$(6.9 \pm 0.9) \times 10^{-4}$		DESIG=235
Γ_{104}	$K_2^*(1980)^+ K^- + c.c. \rightarrow$ $K^+ K^- \pi^0$	$(1.10 \pm_{-0.14}^{0.60}) \times 10^{-5}$		DESIG=382
Γ_{105}	$K_4^*(2045)^+ K^- + c.c. \rightarrow$ $K^+ K^- \pi^0$	$(6.2 \pm_{-1.6}^{2.9}) \times 10^{-6}$		DESIG=383
Γ_{106}	$K_1(1270)^\pm K^\mp$	$< 3.0 \times 10^{-3}$	CL=90%	DESIG=131
Γ_{107}	$K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5) \times 10^{-7}$		DESIG=377
Γ_{108}	$a_2(1320)^\pm \pi^\mp$	$[b] < 4.3 \times 10^{-3}$	CL=90%	DESIG=42
Γ_{109}	$\phi \pi^0$	3×10^{-6} or 1×10^{-7}		DESIG=33; OUR EVAL; \rightarrow UNCHECKED \leftarrow
Γ_{110}	$\phi \pi^+ \pi^-$	$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	DESIG=34
Γ_{111}	$\phi \pi^0 \pi^0$	$(4.9 \pm 1.0) \times 10^{-4}$		DESIG=76
Γ_{112}	$\phi 2(\pi^+ \pi^-)$	$(1.60 \pm 0.32) \times 10^{-3}$		DESIG=35
Γ_{113}	$\phi \eta$	$(7.4 \pm 0.6) \times 10^{-4}$	S=1.2	DESIG=37
Γ_{114}	$\phi \eta'(958)$	$(4.6 \pm 0.5) \times 10^{-4}$	S=2.2	DESIG=38
Γ_{115}	$\phi \eta \eta'$	$(2.32 \pm 0.17) \times 10^{-4}$		DESIG=387
Γ_{116}	$\phi f_0(980)$	$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=41
Γ_{117}	$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	$(2.58 \pm 0.34) \times 10^{-4}$		DESIG=236
Γ_{118}	$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$	$(1.7 \pm 0.5) \times 10^{-4}$		DESIG=237
Γ_{119}	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(4.5 \pm 1.0) \times 10^{-6}$		DESIG=278
Γ_{120}	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \rho^0 \pi^0$	$(1.7 \pm 0.6) \times 10^{-6}$		DESIG=279
Γ_{121}	$\phi f_0(980) \eta \rightarrow \eta \phi \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=229
Γ_{122}	$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$			DESIG=258
Γ_{123}	$\phi(1680)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(6.7 \pm 1.1) \times 10^{-6}$		DESIG=480
Γ_{124}	$X(2000)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(1.70 \pm_{-0.23}^{0.50}) \times 10^{-6}$		DESIG=481
Γ_{125}	$h_1(1900)^0 \pi^0 \rightarrow \phi \eta \pi^0$	$(8.4 \pm_{-1.3}^{1.4}) \times 10^{-6}$		DESIG=482
Γ_{126}	$\phi f_2(1270)$	$(3.2 \pm 0.6) \times 10^{-4}$		DESIG=39
Γ_{127}	$\phi f_1(1285)$	$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=106
Γ_{128}	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow$ $\phi \pi^0 \pi^+ \pi^-$	$(9.4 \pm 2.8) \times 10^{-7}$		DESIG=280

Γ ₁₂₉	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0$	$(2.1 \pm 2.2) \times 10^{-7}$		DESIG=281
Γ ₁₃₀	$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$		DESIG=128
Γ ₁₃₁	$\phi f'_2(1525)$	$(8 \pm 4) \times 10^{-4}$	S=2.7	DESIG=40
Γ ₁₃₂	$\phi X(1835) \rightarrow \phi p \bar{p}$	$< 2.1 \times 10^{-7}$	CL=90%	DESIG=291
Γ ₁₃₃	$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=288
Γ ₁₃₄	$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	$< 6.13 \times 10^{-5}$	CL=90%	DESIG=289
Γ ₁₃₅	$\phi K \bar{K}$	$(1.77 \pm 0.16) \times 10^{-3}$	S=1.3	DESIG=36
Γ ₁₃₆	$\phi f_0(1710) \rightarrow \phi K \bar{K}$	$(3.6 \pm 0.6) \times 10^{-4}$		DESIG=129
Γ ₁₃₇	$\phi K^+ K^-$	$(8.2 \pm 1.1) \times 10^{-4}$		DESIG=295
Γ ₁₃₈	$\phi K_S^0 K_S^0$	$(5.8 \pm 1.5) \times 10^{-4}$		DESIG=305
Γ ₁₃₉	$\phi K^\pm K_S^0 \pi^\mp$	[b] $(7.2 \pm 0.8) \times 10^{-4}$		DESIG=103
Γ ₁₄₀	$\phi K^*(892) \bar{K} + c.c.$	$(2.18 \pm 0.23) \times 10^{-3}$		DESIG=104
Γ ₁₄₁	$b_1(1235)^\pm \pi^\mp$	[b] $(3.0 \pm 0.5) \times 10^{-3}$		DESIG=49
Γ ₁₄₂	$b_1(1235)^0 \pi^0$	$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=160
Γ ₁₄₃	$f'_2(1525) K^+ K^-$	$(1.04 \pm 0.35) \times 10^{-3}$		DESIG=308
Γ ₁₄₄	$\Delta(1232)^+ \bar{p}$	$< 1 \times 10^{-4}$	CL=90%	DESIG=112
Γ ₁₄₅	$\Delta(1232)^{++} \bar{p} \pi^-$	$(1.6 \pm 0.5) \times 10^{-3}$		DESIG=70
Γ ₁₄₆	$\Delta(1232)^{++} \Delta(1232)^{--}$	$(1.10 \pm 0.29) \times 10^{-3}$		DESIG=66
Γ ₁₄₇	$\bar{\Sigma}(1385)^0 p K^-$	$(5.1 \pm 3.2) \times 10^{-4}$		DESIG=74
Γ ₁₄₈	$\Sigma(1385)^0 \bar{\Lambda} + c.c.$	$< 8.2 \times 10^{-6}$	CL=90%	DESIG=111
Γ ₁₄₉	$\Sigma(1385)^- \bar{\Sigma}^+ + c.c.$	[b] $(3.0 \pm 0.7) \times 10^{-4}$		DESIG=68
Γ ₁₅₀	$\Sigma(1385)^+ \bar{\Sigma}^- + c.c.$	$(3.3 \pm 0.8) \times 10^{-4}$		DESIG=450
Γ ₁₅₁	$\Sigma(1385)^- \bar{\Sigma}(1385)^+ + c.c.$	[b] $(1.08 \pm 0.06) \times 10^{-3}$		DESIG=67
Γ ₁₅₂	$\Sigma(1385)^+ \bar{\Sigma}(1385)^- + c.c.$	$(1.25 \pm 0.07) \times 10^{-3}$		DESIG=451
Γ ₁₅₃	$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(1.07 \pm 0.08) \times 10^{-3}$		DESIG=309
Γ ₁₅₄	$\Lambda(1520) \bar{\Lambda} + c.c. \rightarrow \gamma \Lambda \bar{\Lambda}$	$< 4.1 \times 10^{-6}$	CL=90%	DESIG=260
Γ ₁₅₅	$\bar{\Lambda}(1520) \Lambda + c.c.$	$< 1.80 \times 10^{-3}$	CL=90%	DESIG=364
Γ ₁₅₆	$\Xi^0 \Xi^0$	$(1.17 \pm 0.04) \times 10^{-3}$		DESIG=248
Γ ₁₅₇	$\Xi(1530)^- \Xi^+ + c.c.$	$(3.18 \pm 0.08) \times 10^{-4}$		DESIG=107
Γ ₁₅₈	$\Xi(1530)^0 \Xi^0$	$(3.2 \pm 1.4) \times 10^{-4}$		DESIG=108
Γ ₁₅₉	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + c.c.$	[c] $< 1.1 \times 10^{-5}$	CL=90%	DESIG=205
Γ ₁₆₀	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	[c] $< 2.1 \times 10^{-5}$	CL=90%	DESIG=206
Γ ₁₆₁	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	[c] $< 1.6 \times 10^{-5}$	CL=90%	DESIG=207
Γ ₁₆₂	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	[c] $< 5.6 \times 10^{-5}$	CL=90%	DESIG=208
Γ ₁₆₃	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	[c] $< 1.1 \times 10^{-5}$	CL=90%	DESIG=209

Decays into stable hadrons

Γ ₁₆₄	$2(\pi^+ \pi^-) \pi^0$	$(4.2 \pm 0.4) \%$	S=2.1	NODE=M070;CLUMP=B DESIG=9
Γ ₁₆₅	$3(\pi^+ \pi^-) \pi^0$	$(2.9 \pm 0.6) \%$		DESIG=11
Γ ₁₆₆	$\pi^+ \pi^- 3\pi^0$	$(1.9 \pm 0.9) \%$		DESIG=358
Γ ₁₆₇	$\rho^\pm \pi^\mp \pi^0 \pi^0$	$(1.41 \pm 0.22) \%$		DESIG=362
Γ ₁₆₈	$\rho^+ \rho^- \pi^0$	$(6.0 \pm 1.1) \times 10^{-3}$		DESIG=363
Γ ₁₆₉	$\pi^+ \pi^- 4\pi^0$	$(6.5 \pm 1.3) \times 10^{-3}$		DESIG=419
Γ ₁₇₀	$\pi^+ \pi^- \pi^0$	$(2.00 \pm 0.07) \%$	S=2.0	DESIG=7
Γ ₁₇₁	$2(\pi^+ \pi^- \pi^0)$	$(1.61 \pm 0.20) \%$		DESIG=210
Γ ₁₇₂	$\pi^+ \pi^- \pi^0 K^+ K^-$	$(1.52 \pm 0.27) \%$	S=1.4	DESIG=18
Γ ₁₇₃	$\pi^+ \pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		DESIG=6
Γ ₁₇₄	$2(\pi^+ \pi^-)$	$(3.20 \pm 0.25) \times 10^{-3}$	S=1.2	DESIG=8
Γ ₁₇₅	$3(\pi^+ \pi^-)$	$(4.3 \pm 0.4) \times 10^{-3}$		DESIG=10
Γ ₁₇₆	$2(\pi^+ \pi^-) 3\pi^0$	$(6.2 \pm 0.9) \%$		DESIG=411
Γ ₁₇₇	$4(\pi^+ \pi^-) \pi^0$	$(9.0 \pm 3.0) \times 10^{-3}$		DESIG=12
Γ ₁₇₈	$2(\pi^+ \pi^-) \eta$	$(2.29 \pm 0.28) \times 10^{-3}$		DESIG=201
Γ ₁₇₉	$3(\pi^+ \pi^-) \eta$	$(7.2 \pm 1.5) \times 10^{-4}$		DESIG=202
Γ ₁₈₀	$2(\pi^+ \pi^- \pi^0) \eta$	$(1.6 \pm 0.5) \times 10^{-3}$		DESIG=418
Γ ₁₈₁	$\pi^+ \pi^- \pi^0 \pi^0 \eta$	$(2.4 \pm 0.5) \times 10^{-3}$		DESIG=359
Γ ₁₈₂	$\rho^\pm \pi^\mp \pi^0 \eta$	$(1.9 \pm 0.8) \times 10^{-3}$		DESIG=361
Γ ₁₈₃	$K^+ K^-$	$(3.06 \pm 0.05) \times 10^{-4}$		DESIG=13
Γ ₁₈₄	$K_S^0 K_L^0$	$(1.95 \pm 0.11) \times 10^{-4}$	S=2.4	DESIG=75

Γ ₁₈₅	$K_S^0 K_S^0$	< 1.4	$\times 10^{-8}$	CL=95%	DESIG=14
Γ ₁₈₆	$K K \pi$	(6.1 ± 1.0)	$\times 10^{-3}$		DESIG=15
Γ ₁₈₇	$K^+ K^- \pi^0$	(2.88 ± 0.12)	$\times 10^{-3}$		DESIG=334
Γ ₁₈₈	$K_S^0 K^\pm \pi^\mp$	(5.3 ± 0.5)	$\times 10^{-3}$		DESIG=335
Γ ₁₈₉	$K_S^0 K_L^0 \pi^0$	(2.06 ± 0.26)	$\times 10^{-3}$		DESIG=336
Γ ₁₉₀	$K^*(892)^0 \bar{K}^0 + c.c. \rightarrow$ $K_S^0 K_L^0 \pi^0$	(1.21 ± 0.18)	$\times 10^{-3}$		DESIG=339
Γ ₁₉₁	$K_2^*(1430)^0 \bar{K}^0 + c.c. \rightarrow$ $K_S^0 K_L^0 \pi^0$	(4.3 ± 1.3)	$\times 10^{-4}$		DESIG=338
Γ ₁₉₂	$K^+ K^- \pi^+ \pi^-$	(7.0 ± 1.0)	$\times 10^{-3}$		DESIG=16
Γ ₁₉₃	$K^+ K^- \pi^0 \pi^0$	(2.13 ± 0.22)	$\times 10^{-3}$		DESIG=234
Γ ₁₉₄	$K^+ K^- \pi^0 \pi^0 \pi^0$	(1.61 ± 0.29)	$\times 10^{-3}$		DESIG=452
Γ ₁₉₅	$K_S^0 K^\pm \pi^\mp \pi^0 \pi^0$	(5.3 ± 0.7)	$\times 10^{-3}$		DESIG=453
Γ ₁₉₆	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(6.3 ± 0.4)	$\times 10^{-3}$		DESIG=454
Γ ₁₉₇	$K_S^0 K^\pm \rho(770)^\pm \pi^0$	(2.9 ± 0.8)	$\times 10^{-3}$		DESIG=463
Γ ₁₉₈	$K_S^0 K_L^0 \pi^+ \pi^-$	(3.8 ± 0.6)	$\times 10^{-3}$		DESIG=296
Γ ₁₉₉	$K_S^0 K_L^0 \pi^0 \pi^0$	(1.9 ± 0.4)	$\times 10^{-3}$		DESIG=337
Γ ₂₀₀	$K_S^0 K_L^0 \eta$	(1.45 ± 0.33)	$\times 10^{-3}$		DESIG=340
Γ ₂₀₁	$K_S^0 K_S^0 \pi^+ \pi^-$	(1.68 ± 0.19)	$\times 10^{-3}$		DESIG=297
Γ ₂₀₂	$K^\mp K_S^0 \pi^\pm \pi^0$	(5.7 ± 0.5)	$\times 10^{-3}$		DESIG=341
Γ ₂₀₃	$K_S^0 K^\pm \pi^\mp \rho(770)^0$	(3.1 ± 0.5)	$\times 10^{-3}$		DESIG=456
Γ ₂₀₄	$K^+ K^- 2(\pi^+ \pi^-)$	(3.1 ± 1.3)	$\times 10^{-3}$		DESIG=17
Γ ₂₀₅	$K^+ K^- \pi^+ \pi^- \eta$	(4.7 ± 0.7)	$\times 10^{-3}$		DESIG=238
Γ ₂₀₆	$2(K^+ K^-)$	(7.2 ± 0.8)	$\times 10^{-4}$		DESIG=19
Γ ₂₀₇	$K^+ K^- K_S^0 K_S^0$	(4.2 ± 0.7)	$\times 10^{-4}$		DESIG=298
Γ ₂₀₈	$K_S^0 K^*(892)^0 \pi^+ \pi^-$	(1.7 ± 0.6)	$\times 10^{-3}$		DESIG=457
Γ ₂₀₉	$K_S^0 K^*(892)^0 \pi^0 \pi^0$	(1.01 ± 0.18)	$\times 10^{-3}$		DESIG=462
Γ ₂₁₀	$K^\mp K^*(892)^\pm \pi^+ \pi^-$	(3.4 ± 1.2)	$\times 10^{-3}$		DESIG=458
Γ ₂₁₁	$K^*(892)^\pm K^*(892)^0 \pi^\mp$	(4.8 ± 1.0)	$\times 10^{-3}$		DESIG=459
Γ ₂₁₂	$K^\mp K^*(892)^\pm \pi^0 \pi^0$	(1.57 ± 0.32)	$\times 10^{-3}$		DESIG=461
Γ ₂₁₃	$K^*(892)^+ K^*(892)^- \pi^0$	(1.12 ± 0.23)	%		DESIG=460
Γ ₂₁₄	$p \bar{p}$	(2.120 ± 0.029)	$\times 10^{-3}$		DESIG=50
Γ ₂₁₅	$p \bar{p} \pi^0$	(1.19 ± 0.08)	$\times 10^{-3}$	S=1.1	DESIG=52
Γ ₂₁₆	$p \bar{p} \pi^+ \pi^-$	(6.0 ± 0.5)	$\times 10^{-3}$	S=1.3	DESIG=54
Γ ₂₁₇	$p \bar{p} \pi^+ \pi^- \pi^0$	[d] (2.3 ± 0.9)	$\times 10^{-3}$	S=1.9	DESIG=55
Γ ₂₁₈	$p \bar{p} \eta$	(2.00 ± 0.12)	$\times 10^{-3}$		DESIG=56
Γ ₂₁₉	$p \bar{p} \rho$	< 3.1	$\times 10^{-4}$	CL=90%	DESIG=57
Γ ₂₂₀	$p \bar{p} \omega$	(9.8 ± 1.0)	$\times 10^{-4}$	S=1.3	DESIG=58
Γ ₂₂₁	$p \bar{p} \eta'(958)$	(1.29 ± 0.14)	$\times 10^{-4}$	S=2.0	DESIG=59
Γ ₂₂₂	$p \bar{p} a_0(980) \rightarrow p \bar{p} \pi^0 \eta$	(6.8 ± 1.8)	$\times 10^{-5}$		DESIG=276
Γ ₂₂₃	$p \bar{p} \phi$	(5.19 ± 0.33)	$\times 10^{-5}$		DESIG=127
Γ ₂₂₄	$p \bar{n} \pi^-$	(2.12 ± 0.09)	$\times 10^{-3}$		DESIG=53
Γ ₂₂₅	$n \bar{n}$	(2.09 ± 0.16)	$\times 10^{-3}$		DESIG=64
Γ ₂₂₆	$n \bar{n} \pi^+ \pi^-$	(4 ± 4)	$\times 10^{-3}$		DESIG=65
Γ ₂₂₇	$n N(1440)$	seen			DESIG=215;OUR EST;→ UNCHECKED ←
Γ ₂₂₈	$n N(1520)$	seen			DESIG=216;OUR EST;→ UNCHECKED ←
Γ ₂₂₉	$n N(1535)$	seen			DESIG=217;OUR EST;→ UNCHECKED ←
Γ ₂₃₀	$\Lambda \bar{\Lambda}$	(1.88 ± 0.08)	$\times 10^{-3}$	S=2.6	DESIG=60
Γ ₂₃₁	$\Lambda \bar{\Lambda} \pi^0$	(3.8 ± 0.4)	$\times 10^{-5}$		DESIG=109
Γ ₂₃₂	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	(4.3 ± 1.0)	$\times 10^{-3}$		DESIG=261
Γ ₂₃₃	$\Lambda \bar{\Lambda} \eta$	(1.62 ± 0.17)	$\times 10^{-4}$		DESIG=228
Γ ₂₃₄	$\Lambda \bar{\Sigma}^- \pi^+ + c.c.$	[b] (1.26 ± 0.05)	$\times 10^{-3}$	S=1.2	DESIG=71
Γ ₂₃₅	$\Lambda \bar{\Sigma}^+ \pi^- + c.c.$	(1.21 ± 0.07)	$\times 10^{-3}$	S=1.8	DESIG=449
Γ ₂₃₆	$\rho K^- \bar{\Lambda} + c.c.$	(8.6 ± 1.1)	$\times 10^{-4}$		DESIG=72
Γ ₂₃₇	$\rho K^- \bar{\Sigma}^0$	(2.9 ± 0.8)	$\times 10^{-4}$		DESIG=73
Γ ₂₃₈	$\rho K_S^0 \bar{\Sigma}^- + c.c.$	(2.73 ± 0.05)	$\times 10^{-4}$		DESIG=474
Γ ₂₃₉	$\bar{\Lambda} n K_S^0 + c.c.$	(6.5 ± 1.1)	$\times 10^{-4}$		DESIG=225
Γ ₂₄₀	$\Lambda \bar{\Sigma}^+ + c.c.$	(2.83 ± 0.23)	$\times 10^{-5}$		DESIG=61
Γ ₂₄₁	$\Sigma^+ \bar{\Sigma}^-$	(1.07 ± 0.04)	$\times 10^{-3}$		DESIG=247
Γ ₂₄₂	$\Sigma^0 \bar{\Sigma}^0$	(1.172 ± 0.032)	$\times 10^{-3}$	S=1.4	DESIG=63
Γ ₂₄₃	$\Sigma^+ \bar{\Sigma}^- \eta$	(6.3 ± 0.4)	$\times 10^{-5}$		DESIG=448
Γ ₂₄₄	$\Xi^- \bar{\Xi}^+$	(9.7 ± 0.8)	$\times 10^{-4}$	S=1.4	DESIG=62

Radiative decays

			NODE=M070;CLUMP=C
Γ ₂₄₅	$\gamma\eta_c(1S)$	(1.41 ± 0.14) %	S=1.3 DESIG=85
Γ ₂₄₆	$\gamma\eta_c(1S) \rightarrow 3\gamma$	seen	DESIG=246;OUR EST;→ UNCHECKED ←
Γ ₂₄₇	$\gamma\eta_c(1S) \rightarrow \gamma\eta\eta'$	seen	DESIG=391;OUR EST;→ UNCHECKED ←
Γ ₂₄₈	3γ	(1.16 ± 0.22) × 10 ⁻⁵	DESIG=81
Γ ₂₄₉	4γ	< 9 × 10 ⁻⁶	CL=90% DESIG=244
Γ ₂₅₀	5γ	< 1.5 × 10 ⁻⁵	CL=90% DESIG=245
Γ ₂₅₁	$\gamma\pi^0$	(3.39 ± 0.08) × 10 ⁻⁵	DESIG=82
Γ ₂₅₂	$\gamma\pi^0\pi^0$	(1.15 ± 0.05) × 10 ⁻³	DESIG=283
Γ ₂₅₃	$\gamma 2\pi^+ 2\pi^-$	(2.8 ± 0.5) × 10 ⁻³	S=1.9 DESIG=95
Γ ₂₅₄	$\gamma f_2(1270) f_2(1270)$	(9.5 ± 1.7) × 10 ⁻⁴	DESIG=203
Γ ₂₅₅	$\gamma f_2(1270) f_2(1270)$ (non resonant)	(8.2 ± 1.9) × 10 ⁻⁴	DESIG=204
Γ ₂₅₆	$\gamma\pi^+\pi^- 2\pi^0$	(8.3 ± 3.1) × 10 ⁻³	DESIG=99
Γ ₂₅₇	$\gamma K_S^0 K_S^0$	(8.1 ± 0.4) × 10 ⁻⁴	DESIG=378
Γ ₂₅₈	$\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}]$	(7 ± 4) × 10 ⁻⁴	S=2.1 DESIG=176
Γ ₂₅₉	$\gamma K^+ K^- \pi^+ \pi^-$	(2.1 ± 0.6) × 10 ⁻³	DESIG=143
Γ ₂₆₀	$\gamma K^*(892) \bar{K}^*(892)$	(4.0 ± 1.3) × 10 ⁻³	DESIG=145
Γ ₂₆₁	$\gamma\eta$	(1.090 ± 0.013) × 10 ⁻³	DESIG=83
Γ ₂₆₂	$\gamma\eta\pi^0$	(2.14 ± 0.31) × 10 ⁻⁵	DESIG=292
Γ ₂₆₃	$\gamma f_0(500) \rightarrow \gamma\pi\pi$		DESIG=398
Γ ₂₆₄	$\gamma f_0(500) \rightarrow \gamma K\bar{K}$		DESIG=399
Γ ₂₆₅	$\gamma f_0(500) \rightarrow \gamma\eta\eta$		DESIG=400
Γ ₂₆₆	$\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0$	< 2.5 × 10 ⁻⁶	CL=95% DESIG=293
Γ ₂₆₇	$\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0$	< 6.6 × 10 ⁻⁶	CL=95% DESIG=294
Γ ₂₆₈	$\gamma\eta\pi\pi$	(6.1 ± 1.0) × 10 ⁻³	DESIG=96
Γ ₂₆₉	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	(6.2 ± 2.4) × 10 ⁻⁴	DESIG=142
Γ ₂₇₀	$\gamma\eta'(958)$	(5.28 ± 0.06) × 10 ⁻³	S=1.3 DESIG=84
Γ ₂₇₁	$\gamma f_0(980) \rightarrow \gamma\pi\pi$		DESIG=393
Γ ₂₇₂	$\gamma f_0(980) \rightarrow \gamma K\bar{K}$		DESIG=394
Γ ₂₇₃	$\gamma\rho\rho$	(4.5 ± 0.8) × 10 ⁻³	DESIG=94
Γ ₂₇₄	$\gamma\rho\omega$	< 5.4 × 10 ⁻⁴	CL=90% DESIG=226
Γ ₂₇₅	$\gamma\rho\phi$	< 8.8 × 10 ⁻⁵	CL=90% DESIG=227
Γ ₂₇₆	$\gamma\omega\omega$	(1.61 ± 0.33) × 10 ⁻³	DESIG=97
Γ ₂₇₇	$\gamma\phi\phi$	(4.0 ± 1.2) × 10 ⁻⁴	S=2.1 DESIG=98
Γ ₂₇₈	$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	(2.8 ± 0.6) × 10 ⁻³	S=1.6 DESIG=89
Γ ₂₇₉	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	(7.8 ± 2.0) × 10 ⁻⁵	S=1.8 DESIG=171
Γ ₂₈₀	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	(3.0 ± 0.5) × 10 ⁻⁴	DESIG=170
Γ ₂₈₁	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	(1.7 ± 0.4) × 10 ⁻³	S=1.3 DESIG=124
Γ ₂₈₂	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	< 8.2 × 10 ⁻⁵	CL=95% DESIG=212
Γ ₂₈₃	$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0$	(1.50 ± 0.16) × 10 ⁻⁵	DESIG=476
Γ ₂₈₄	$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^0\pi^0\pi^0$	(7.1 ± 1.1) × 10 ⁻⁶	DESIG=477
Γ ₂₈₅	$\gamma\eta(1405) \rightarrow \gamma\gamma\gamma$	< 2.63 × 10 ⁻⁶	CL=90% DESIG=348
Γ ₂₈₆	$\gamma\eta(1475) \rightarrow \gamma\gamma\gamma$	< 1.86 × 10 ⁻⁶	CL=90% DESIG=349
Γ ₂₈₇	$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	(1.3 ± 0.9) × 10 ⁻⁴	DESIG=125
Γ ₂₈₈	$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	(1.98 ± 0.33) × 10 ⁻³	DESIG=224
Γ ₂₈₉	$\gamma\eta(1760) \rightarrow \gamma\gamma\gamma$	< 4.80 × 10 ⁻⁶	CL=90% DESIG=347
Γ ₂₉₀	$\gamma\eta(2225)$	(3.14 ± 0.50 / 0.19) × 10 ⁻⁴	DESIG=126
Γ ₂₉₁	$\gamma f_2(1270)$	(1.63 ± 0.12) × 10 ⁻³	S=1.3 DESIG=86
Γ ₂₉₂	$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	(2.58 ± 0.60 / 0.22) × 10 ⁻⁵	DESIG=373
Γ ₂₉₃	$\gamma f_1(1285)$	(6.1 ± 0.8) × 10 ⁻⁴	DESIG=88
Γ ₂₉₄	$\gamma f_0(1370) \rightarrow \gamma\pi\pi$		DESIG=395
Γ ₂₉₅	$\gamma f_0(1370) \rightarrow \gamma K\bar{K}$	(4.2 ± 1.5) × 10 ⁻⁴	DESIG=284
Γ ₂₉₆	$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	(1.1 ± 0.4) × 10 ⁻⁵	DESIG=368
Γ ₂₉₇	$\gamma f_0(1370) \rightarrow \gamma\eta\eta$		DESIG=396
Γ ₂₉₈	$\gamma f_0(1370) \rightarrow \gamma\eta\eta'$		DESIG=397
Γ ₂₉₉	$\gamma f_1(1420) \rightarrow \gamma K\bar{K}\pi$	(7.9 ± 1.3) × 10 ⁻⁴	DESIG=175

Γ ₃₀₀	$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	$(1.09 \pm 0.24) \times 10^{-4}$		DESIG=172
Γ ₃₀₁	$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	$(1.7 \pm_{-1.4}^{0.6}) \times 10^{-5}$		DESIG=265
Γ ₃₀₂	$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \pm_{-0.60}^{0.24}) \times 10^{-5}$		DESIG=369
Γ ₃₀₃	$\gamma f_0(1500) \rightarrow \gamma \eta \eta'$			DESIG=401
Γ ₃₀₄	$\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=141
Γ ₃₀₅	$\gamma f_2'(1525)$	$(5.7 \pm_{-0.5}^{0.8}) \times 10^{-4}$	S=1.5	DESIG=87
Γ ₃₀₆	$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \pm_{-0.5}^{0.7}) \times 10^{-5}$		DESIG=374
Γ ₃₀₇	$\gamma f_2'(1525) \rightarrow \gamma \eta \eta$	$(3.4 \pm 1.4) \times 10^{-5}$		DESIG=268
Γ ₃₀₈	$\gamma f_2'(1565) \rightarrow \gamma \eta \eta'$			DESIG=432
Γ ₃₀₉	$\gamma f_2(1640) \rightarrow \gamma \omega \omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=222
Γ ₃₁₀	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=135
Γ ₃₁₁	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(9.5 \pm_{-0.5}^{1.0}) \times 10^{-4}$	S=1.5	DESIG=91
Γ ₃₁₂	$\gamma f_0(1710) \rightarrow \gamma \omega \omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=221
Γ ₃₁₃	$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$(2.4 \pm_{-0.7}^{1.2}) \times 10^{-4}$		DESIG=266
Γ ₃₁₄	$\gamma f_0(1710) \rightarrow \gamma \eta \eta'$			DESIG=402
Γ ₃₁₅	$\gamma f_0(1710) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=262
Γ ₃₁₆	$\gamma f_0(1770) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \pm_{-0.33}^{0.20}) \times 10^{-5}$		DESIG=370
Γ ₃₁₇	$\gamma f_2(1810) \rightarrow \gamma \eta \eta$	$(5.4 \pm_{-2.4}^{3.5}) \times 10^{-5}$		DESIG=269
Γ ₃₁₈	$\gamma \eta_1(1855) \rightarrow \gamma \eta \eta'$	$(2.7 \pm_{-0.5}^{0.4}) \times 10^{-6}$		DESIG=447
Γ ₃₁₉	$\gamma f_0(1770) \rightarrow \gamma \eta \eta'$			DESIG=431
Γ ₃₂₀	$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
Γ ₃₂₁	$\gamma f_2(1950) \rightarrow$ $\gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144
Γ ₃₂₂	$\gamma f_2(2010) \rightarrow \gamma \eta \eta'$			DESIG=440
Γ ₃₂₃	$\gamma f_0(2020) \rightarrow \gamma \pi \pi$			DESIG=403
Γ ₃₂₄	$\gamma f_0(2020) \rightarrow \gamma K \bar{K}$			DESIG=404
Γ ₃₂₅	$\gamma f_0(2020) \rightarrow \gamma \eta \eta$			DESIG=405
Γ ₃₂₆	$\gamma f_0(2020) \rightarrow \gamma \eta' \eta'$	$(2.63 \pm_{-0.50}^{0.32}) \times 10^{-4}$		DESIG=426
Γ ₃₂₇	$\gamma f_0(2020) \rightarrow \gamma \eta \eta'$			DESIG=438
Γ ₃₂₈	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=100
Γ ₃₂₉	$\gamma f_4(2050) \rightarrow \gamma \eta \eta'$			DESIG=433
Γ ₃₃₀	$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \pm_{-0.30}^{0.60}) \times 10^{-4}$		DESIG=267
Γ ₃₃₁	$\gamma f_0(2100) \rightarrow \gamma K \bar{K}$			DESIG=406
Γ ₃₃₂	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$		DESIG=286
Γ ₃₃₃	$\gamma f_0(2200)$	seen		DESIG=123;OUR EST;→ UNCHECKED ←
Γ ₃₃₄	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$		DESIG=285
Γ ₃₃₅	$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	$(2.72 \pm_{-0.50}^{0.19}) \times 10^{-4}$		DESIG=371
Γ ₃₃₆	$\gamma f_0(2200) \rightarrow \gamma \pi \pi$			DESIG=407
Γ ₃₃₇	$\gamma f_0(2200) \rightarrow \gamma \eta \eta$			DESIG=408
Γ ₃₃₈	$\gamma f_J(2220)$	seen		DESIG=92;OUR EST;→ UNCHECKED ←
Γ ₃₃₉	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 3.9 \times 10^{-5}$	CL=90%	DESIG=136
Γ ₃₄₀	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 4.1 \times 10^{-5}$	CL=90%	DESIG=137
Γ ₃₄₁	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ ₃₄₂	$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	$(4.9 \pm 0.7) \times 10^{-5}$		DESIG=372
Γ ₃₄₃	$\gamma f_0(2330) \rightarrow \gamma \pi \pi$			DESIG=409
Γ ₃₄₄	$\gamma f_0(2330) \rightarrow \gamma \eta \eta$			DESIG=410
Γ ₃₄₅	$\gamma f_0(2330) \rightarrow \gamma \eta' \eta'$	$(6.1 \pm_{-1.8}^{4.0}) \times 10^{-6}$		DESIG=427
Γ ₃₄₆	$\gamma f_0(2330) \rightarrow \gamma \eta \eta'$			DESIG=439
Γ ₃₄₇	$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \pm_{-2.2}^{2.4}) \times 10^{-5}$		DESIG=270
Γ ₃₄₈	$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	$(5.5 \pm_{-1.5}^{4.0}) \times 10^{-5}$		DESIG=375

Γ ₃₄₉	$\gamma f_2(2340) \rightarrow \gamma \eta' \eta'$	$(8.7 \begin{smallmatrix} + & 0.9 \\ - & 1.8 \end{smallmatrix}) \times 10^{-6}$			DESIG=428
Γ ₃₅₀	$\gamma f_0(2470) \rightarrow \gamma \eta' \eta'$	$(8.2 \begin{smallmatrix} + & 4.0 \\ - & 2.8 \end{smallmatrix}) \times 10^{-7}$			DESIG=429
Γ ₃₅₁	$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.7 \begin{smallmatrix} + & 0.6 \\ - & 0.8 \end{smallmatrix}) \times 10^{-4}$	S=1.6		DESIG=213
Γ ₃₅₂	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \begin{smallmatrix} + & 1.5 \\ - & 0.9 \end{smallmatrix}) \times 10^{-5}$			DESIG=254
Γ ₃₅₃	$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \begin{smallmatrix} + & 2.0 \\ - & 1.3 \end{smallmatrix}) \times 10^{-5}$			DESIG=282
Γ ₃₅₄	$\gamma X(1835) \rightarrow \gamma \gamma \phi(1020)$				DESIG=346
Γ ₃₅₅	$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	< 3.56	$\times 10^{-6}$	CL=90%	DESIG=350
Γ ₃₅₆	$\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \begin{smallmatrix} + & 0.7 \\ - & 0.8 \end{smallmatrix}) \times 10^{-5}$			DESIG=264
Γ ₃₅₇	$\gamma \eta(2370) \rightarrow \gamma K^+ K^- \eta'$	$(1.8 \pm 0.7) \times 10^{-5}$			DESIG=388
Γ ₃₅₈	$\gamma \eta(2370) \rightarrow \gamma K_S^0 K_S^0 \eta'$	$(1.2 \pm 0.5) \times 10^{-5}$			DESIG=389
Γ ₃₅₉	$\gamma \eta(2370) \rightarrow \gamma \eta \eta \eta'$	< 9.2	$\times 10^{-6}$	CL=90%	DESIG=390
Γ ₃₆₀	$\gamma D^0 + c.c.$	< 9.1	$\times 10^{-8}$	CL=90%	DESIG=479
Γ ₃₆₁	$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$			DESIG=90
Γ ₃₆₂	$\gamma p \bar{p} \pi^+ \pi^-$	< 7.9	$\times 10^{-4}$	CL=90%	DESIG=93
Γ ₃₆₃	$\gamma \Lambda \bar{\Lambda}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=200
Γ ₃₆₄	$\gamma A^0 \rightarrow \gamma$ invisible	[e] < 1.7	$\times 10^{-6}$	CL=90%	DESIG=251
Γ ₃₆₅	$\gamma A^0 \rightarrow \gamma \gamma \gamma$	< 4.9	$\times 10^{-7}$	CL=95%	DESIG=469
Γ ₃₆₆	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	[f] < 7.8	$\times 10^{-7}$	CL=90%	DESIG=259
Dalitz decays					
Γ ₃₆₇	$\pi^0 e^+ e^-$	$(7.6 \pm 1.4) \times 10^{-7}$			NODE=M070;CLUMP=G DESIG=271
Γ ₃₆₈	$\eta e^+ e^-$	$(1.42 \pm 0.08) \times 10^{-5}$			DESIG=272
Γ ₃₆₉	$\eta'(958) e^+ e^-$	$(6.59 \pm 0.18) \times 10^{-5}$			DESIG=273
Γ ₃₇₀	$\eta(1405) e^+ e^- \rightarrow$ $f_0(980) \pi^0 e^+ e^- \rightarrow$ $\pi^+ \pi^- \pi^0 e^+ e^-$	$(2.04 \pm 0.22) \times 10^{-7}$			DESIG=475
Γ ₃₇₁	$X(1835) e^+ e^-$, $X \rightarrow \pi^+ \pi^- \eta'$	$(3.58 \pm 0.25) \times 10^{-6}$			DESIG=423
Γ ₃₇₂	$X(2120) e^+ e^-$, $X \rightarrow \pi^+ \pi^- \eta'$	$(8.2 \pm 1.3) \times 10^{-7}$			DESIG=425
Γ ₃₇₃	$\eta(2370) e^+ e^-$, $\eta \rightarrow \pi^+ \pi^- \eta'$	$(1.08 \pm 0.17) \times 10^{-6}$			DESIG=424
Γ ₃₇₄	$\eta U \rightarrow \eta e^+ e^-$	[g] < 9.11	$\times 10^{-7}$	CL=90%	DESIG=352
Γ ₃₇₅	$\eta'(958) U \rightarrow \eta'(958) e^+ e^-$	[g] < 2.0	$\times 10^{-7}$	CL=90%	DESIG=366
Γ ₃₇₆	$\phi e^+ e^-$	< 1.2	$\times 10^{-7}$	CL=90%	DESIG=384
Weak decays					
Γ ₃₇₇	$D^- e^+ \nu_e + c.c.$	< 7.1	$\times 10^{-8}$	CL=90%	NODE=M070;CLUMP=E DESIG=218
Γ ₃₇₈	$D^- \mu^+ \nu_\mu + c.c.$	< 5.6	$\times 10^{-7}$	CL=90%	DESIG=468
Γ ₃₇₉	$\bar{D}^0 e^+ e^- + c.c.$	< 8.5	$\times 10^{-8}$	CL=90%	DESIG=219
Γ ₃₈₀	$D_s^- e^+ \nu_e + c.c.$	< 1.3	$\times 10^{-6}$	CL=90%	DESIG=220
Γ ₃₈₁	$D_s^{*-} e^+ \nu_e + c.c.$	< 1.8	$\times 10^{-6}$	CL=90%	DESIG=290
Γ ₃₈₂	$D^- \pi^+ + c.c.$	< 7.0	$\times 10^{-8}$	CL=90%	DESIG=241
Γ ₃₈₃	$D^- \rho^+ + c.c.$	< 6.0	$\times 10^{-7}$	CL=90%	DESIG=464
Γ ₃₈₄	$\bar{D}^0 \pi^0 + c.c.$	< 4.7	$\times 10^{-7}$	CL=90%	DESIG=465
Γ ₃₈₅	$\bar{D}^0 K^0 + c.c.$	< 1.7	$\times 10^{-4}$	CL=90%	DESIG=242
Γ ₃₈₆	$\bar{D}^0 \bar{K}^{*0} + c.c.$	< 2.5	$\times 10^{-6}$	CL=90%	DESIG=275
Γ ₃₈₇	$\bar{D}^0 \eta + c.c.$	< 6.8	$\times 10^{-7}$	CL=90%	DESIG=466
Γ ₃₈₈	$\bar{D}^0 \rho^0 + c.c.$	< 5.2	$\times 10^{-7}$	CL=90%	DESIG=467
Γ ₃₈₉	$D_s^- \pi^+ + c.c.$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=243
Γ ₃₉₀	$D_s^- \rho^+ + c.c.$	< 1.3	$\times 10^{-5}$	CL=90%	DESIG=274
Charge conjugation (C), Parity (P), Lepton Family number (LF) violating modes					
Γ ₃₉₁	$\gamma \gamma$	C	< 2.7	$\times 10^{-7}$	CL=90% DESIG=80
Γ ₃₉₂	$\gamma \phi$	C	< 1.4	$\times 10^{-6}$	CL=90% DESIG=277
Γ ₃₉₃	$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90% DESIG=177
Γ ₃₉₄	$e^\pm \tau^\mp$	LF	< 7.5	$\times 10^{-8}$	CL=90% DESIG=178
Γ ₃₉₅	$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90% DESIG=179
Γ ₃₉₆	$\Lambda_c^+ e^- + c.c.$		< 6.9	$\times 10^{-8}$	CL=90% DESIG=379

Other decays

Γ_{397} invisible $< 7 \times 10^{-4}$ CL=90%
 $\Gamma_{398} \mu^+ \mu^- X^0 \rightarrow \mu^+ \mu^- + \text{invisible}$

NODE=M070;CLUMP=F

DESIG=240

DESIG=470

[a] For $E_\gamma > 100$ MeV.

LINKAGE=EGM

[b] The value is for the sum of the charge states or particle/antiparticle states indicated.

LINKAGE=SG

[c] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54 \text{ GeV}/c^2$ mass and a width of less than $25 \text{ MeV}/c^2$.

LINKAGE=THT

[d] Includes $\rho\bar{\rho}\pi^+\pi^-\gamma$ and excludes $\rho\bar{\rho}\eta$, $\rho\bar{\rho}\omega$, $\rho\bar{\rho}\eta'$.

LINKAGE=MF

[e] For a narrow state A with mass less than 960 MeV.

LINKAGE=NSA

[f] For a narrow scalar or pseudoscalar A^0 with mass 0.21–3.0 GeV.

LINKAGE=NA0

[g] For a dark photon U with mass between 100 and 2100 MeV.

LINKAGE=DPH

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and B^\pm with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

 $J/\psi(1S)$ PARTIAL WIDTHS

NODE=M070220

 $\Gamma(\text{hadrons})$ **Γ_1**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$81.37 \pm 1.36 \pm 1.30$	¹ ANASHIN	20	KEDR e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
74.1 \pm 8.1	BAI	95B	BES e^+e^-
59 \pm 24	BALDINI-...	75	FRAG e^+e^-
59 \pm 14	BOYARSKI	75	MRK1 e^+e^-
50 \pm 25	ESPOSITO	75B	FRAM e^+e^-

NODE=M070W3

NODE=M070W3

¹ Based on the same dataset as ANASHIN 18A and correlated to the values reported there.

NODE=M070W3;LINKAGE=A

 $\Gamma(e^+e^-)$ **Γ_5**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.53 ± 0.10	OUR AVERAGE			
$5.550 \pm 0.056 \pm 0.089$		^{1,2} ANASHIN	18A	KEDR e^+e^-
$5.36^{+0.29}_{-0.28}$		³ HSUEH	92	RVUE See \mathcal{T} mini-review
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$5.58 \pm 0.05 \pm 0.08$		⁴ ABLIKIM	16Q	BES3 $3.773 e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.71 ± 0.16	13k	⁵ ADAMS	06A	CLEO $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57 ± 0.19	7.8k	⁵ AUBERT	04	BABR $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14 ± 0.39		BAI	95B	BES e^+e^-
4.72 ± 0.35		ALEXANDER	89	RVUE See \mathcal{T} mini-review
4.4 ± 0.6		³ BRANDELIK	79c	DASP e^+e^-
4.6 ± 0.8		⁶ BALDINI-...	75	FRAG e^+e^-
4.8 ± 0.6		BOYARSKI	75	MRK1 e^+e^-
4.6 ± 1.0		ESPOSITO	75B	FRAM e^+e^-

NODE=M070W1

NODE=M070W1

OCCUR=4

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow \text{hadrons}$ near the $J/\psi(1S)$ peak.

NODE=M070W1;LINKAGE=D

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

NODE=M070W1;LINKAGE=E

³ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M070W1;LINKAGE=F

⁴ Using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.973 \pm 0.007 \pm 0.037)\%$ from ABLIKIM 13R.

NODE=M070W1;LINKAGE=A

⁵ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.

NODE=M070W1;LINKAGE=AA

⁶ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.

NODE=M070W1;LINKAGE=B

$\Gamma(\mu^+\mu^-)$ Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.13±0.52	BAI	95B	BES e^+e^-
4.8 ±0.6	BOYARSKI	75	MRK1 e^+e^-
5 ±1	ESPOSITO	75B	FRAM e^+e^-

NODE=M070W2
 NODE=M070W2

 $\Gamma(\gamma\gamma)$ Γ_{391}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.4	90	BRANDELIK	79C	DASP e^+e^-

NODE=M070W70
 NODE=M070W70

 $J/\psi(1S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M070225

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel(l) in the e^+e^- annihilation.

NODE=M070225

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_5/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4.884±0.048±0.078	^{1,2} ANASHIN	18A	KEDR e^+e^-
4 ±0.8	³ BALDINI-...	75	FRAG e^+e^-
3.9 ±0.8	³ ESPOSITO	75B	FRAM e^+e^-

NODE=M070G3
 NODE=M070G3

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow \text{hadrons}$ near the $J/\psi(1S)$ peak.

NODE=M070G3;LINKAGE=A

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

NODE=M070G3;LINKAGE=B

³ Data redundant with branching ratios or partial widths above.

NODE=M070G3;LINKAGE=S

 $\Gamma(e^+e^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_5/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
333.1± 6.6±4.0	^{1,2} ANASHIN	18A	KEDR e^+e^-
332.3± 6.4±4.8	ANASHIN	10	KEDR 3.097 $e^+e^- \rightarrow e^+e^-$
350 ± 20	BRANDELIK	79C	DASP e^+e^-
320 ± 70	³ BALDINI-...	75	FRAG e^+e^-
340 ± 90	³ ESPOSITO	75B	FRAM e^+e^-
360 ±100	³ FORD	75	SPEC e^+e^-

NODE=M070G1
 NODE=M070G1

OCCUR=2

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow \text{hadrons}$ near the $J/\psi(1S)$ peak.

NODE=M070G1;LINKAGE=A

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

NODE=M070G1;LINKAGE=B

³ Data redundant with branching ratios or partial widths above.

NODE=M070G1;LINKAGE=S

 $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
333 ± 4 OUR AVERAGE				
333.4± 2.5±4.4		ABLIKIM	16Q	BES3 3.773 $e^+e^- \rightarrow \mu^+\mu^-\gamma$
331.8± 5.2±6.3		ANASHIN	10	KEDR 3.097 $e^+e^- \rightarrow \mu^+\mu^-$
338.4± 5.8±7.1	13k	ADAMS	06A	CLEO $e^+e^- \rightarrow \mu^+\mu^-\gamma$
330.1± 7.7±7.3	7.8k	AUBERT	04	BABR $e^+e^- \rightarrow \mu^+\mu^-\gamma$

NODE=M070G2
 NODE=M070G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

510 ±90		DASP	75	DASP e^+e^-
380 ±50	¹	ESPOSITO	75B	FRAM e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G2;LINKAGE=S

 $\Gamma(\eta\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ±0.4 OUR AVERAGE				
2.34±0.43±0.16	49	LEES	18	BABR $e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$
2.22±0.96±0.02	9	¹ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$

NODE=M070G25
 NODE=M070G25

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow \pi^+\pi^-\pi^0)] = 0.51 \pm 0.22 \pm 0.03$ eV which we divide by our best value $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.02 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G25;LINKAGE=AU

$$\Gamma(\eta\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
64.8±11.1±0.4	200	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M070Q20
NODE=M070Q20

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] = 21.1 \pm 1.7 \pm 3.2$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q20;LINKAGE=A

$$\Gamma(\eta\pi^+\pi^-3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
26.9±5.7±0.1	101	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-3\pi^0\gamma\gamma)$

NODE=M070Q19
NODE=M070Q19

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-3\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.6 \pm 1.6 \pm 1.6$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q19;LINKAGE=A

$$\Gamma(\eta K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
4.76±1.64±0.03	¹ LEES	23 BABR	$e^+e^- \rightarrow \gamma_{ISR}$ hadrons

NODE=M070Q54
NODE=M070Q54

¹ LEES 23 reports $[\Gamma(J/\psi(1S) \rightarrow \eta K^+K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] = 1.55 \pm 0.51 \pm 0.16$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q54;LINKAGE=A

$$\Gamma(\eta K^\pm K_S^0 \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±1.4±0.4	44	LEES	17D BABR	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G38
NODE=M070G38

$$\Gamma(\rho^\pm \pi^\mp \pi^+ \pi^- 2\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
155±26±36	14k	LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q13
NODE=M070Q13

$$\Gamma(\rho^+ \rho^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
32±13±15	14k	LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q14
NODE=M070Q14

$$\Gamma(\rho^\mp K^\pm K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.4±1.0±1.9	130	LEES	17D BABR	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G31
NODE=M070G31

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{44}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
53.6±5.0±0.4	788	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$

NODE=M070G24
NODE=M070G24

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 47.8 \pm 3.1 \pm 3.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.8±3.5±0.2	398	¹ LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0\gamma$

NODE=M070P54
NODE=M070P54

¹ LEES 18E reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 24.8 \pm 1.8 \pm 2.5$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P54;LINKAGE=A

$$\Gamma(\omega 3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.5±3.1±0.1	89	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M070Q18
NODE=M070Q18

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \omega 3\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 9.4 \pm 2.3 \pm 1.5$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q18;LINKAGE=A

$$\Gamma(\omega\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{48}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
16.9±7.6±0.2	¹ LEES	21c	BABR $e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M070Q21
NODE=M070Q21

¹ Different final state as in AUBERT 06. LEES 21c reports $[\Gamma(J/\psi(1S) \rightarrow \omega\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 4.9 \pm 2.1 \pm 0.7$ eV which we divide by our best values $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.21) \times 10^{-2}$, $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070Q21;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{49}\Gamma_5/\Gamma$$

VALUE (10^{-2} keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.3±0.2	170	AUBERT	06D	BABR $10.6 e^+e^- \rightarrow \omega\pi^+\pi^-\pi^0\gamma$

NODE=M070G8
NODE=M070G8

$$\Gamma(\omega\pi^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{50}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.90±0.96±0.01	27	¹ LEES	18E	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0\eta\gamma$

NODE=M070P58
NODE=M070P58

¹ LEES 18E reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^0\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 1.7 \pm 0.8 \pm 0.3$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P58;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-2\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{52}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
185±30±1	14k	¹ LEES	21	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q11
NODE=M070Q11

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+\pi^-2\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 165 \pm 9 \pm 25$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q11;LINKAGE=A

$$\Gamma(\omega K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{64}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70±1.98±0.03	24	¹ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow \omega K^+K^-\gamma$

NODE=M070G29
NODE=M070G29

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega K\bar{K}) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 3.3 \pm 1.3 \pm 1.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G29;LINKAGE=AU

$$\Gamma(K^+K^*(892)^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{73}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0±1.7±1.3	AUBERT	08s	BABR $10.6 e^+e^- \rightarrow K^+K^*(892)^-\gamma$

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+K^*(892)^- + \text{c.c.} \rightarrow K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{74}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96±0.85±0.70	155	AUBERT	08s	BABR $10.6 e^+e^- \rightarrow K^+K^-\pi^0\gamma$

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+K^*(892)^- + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{75}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76±1.70±1.00	89	AUBERT	08s	BABR $10.6 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{76}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±2.5±1.5	AUBERT	08s	BABR $10.6 e^+e^- \rightarrow K^0\bar{K}^*(892)^0\gamma$

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0\bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0K^\pm\pi^\mp + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{77}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
17.70±1.70±1.00	94	AUBERT	08s	BABR $10.6 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G22
NODE=M070G22

$$\Gamma(\bar{K}^*(892)^0 K^+\pi^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{78}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
42.6±4.8±7.2	99	¹ LEES	17D	BABR $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G39
NODE=M070G39

¹ Dividing by 1/6 to account for $B(K^*(892)^0 \rightarrow K_S^0\pi^0)=1/6$.

NODE=M070G39;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{79} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
22.8 ± 2.8 ± 6.8	80	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

¹ Dividing by 1/4 to account for $B(K^*(892)^\pm \rightarrow K_S^0 \pi^\pm) = 1/4$.

NODE=M070G32
NODE=M070G32

NODE=M070G32;LINKAGE=A

$$\Gamma(K^*(892)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{80} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.0 ± 2.8 OUR AVERAGE				
9.2 ± 1.2 ± 3.2	64	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$
14.8 ± 4.8 ± 1.2	53	² LEES	14H BABR	$e^+ e^- \rightarrow \pi^\mp \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by 1/2 to take into account $B(K^*(892)^\pm \rightarrow K^\pm \pi^\mp) = 1/2$.

² Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY4
NODE=M070GY4

NODE=M070GY4;LINKAGE=B

NODE=M070GY4;LINKAGE=A

$$\Gamma(K^*(892)^+ K_S^0 \pi^- + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{81} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.7 ± 1.2 ± 0.3	53	LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY5
NODE=M070GY5

$$\Gamma(K^*(892)^0 K_S^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{84} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.60 ± 0.75 ± 2.25	34	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

¹ Dividing by 2/3 to account for $B(K^*(892)^0 \rightarrow K^+ \pi^-) = 2/3$.

NODE=M070G33
NODE=M070G33

NODE=M070G33;LINKAGE=A

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{86} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28 ± 0.34 ± 0.07	47 ± 12	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.28 ± 0.40 ± 0.11 25 ± 8 ^{1,2} AUBERT 07AK BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Dividing by $(2/3)^2$ to take twice into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3 B(K^{*0} \rightarrow K \pi)$.

² Superseded by LEES 12F.

NODE=M070G01
NODE=M070G01

NODE=M070G01;LINKAGE=AE

NODE=M070G01;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^*(892)^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{87} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.80 ± 0.48 ± 0.32	1 ± 5	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by $(1/4)^2$ to take twice into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY8
NODE=M070GY8

NODE=M070GY8;LINKAGE=A

$$\Gamma(K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{98} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.1 ± 9.8 ± 0.5	35	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by 1/4 to take into account $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K^*(1430) \rightarrow K \pi)$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 10.0 \pm 4.8 \pm 0.8$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY6
NODE=M070GY6

NODE=M070GY6;LINKAGE=A

NODE=M070GY6;LINKAGE=B

$$\Gamma(\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{99} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.8 ± 1.4 ± 0.6	710	^{1,2,3} LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

33 ± 4 ± 1 317 ^{2,4} AUBERT 07AK BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 12.89 \pm 0.54 \pm 0.41$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3 B(K^{*0} \rightarrow K \pi)$.

³ The $K_2^*(1430)$ cannot be distinguished from the $K_0^*(1430)$.

⁴ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 16.4 \pm 1.1 \pm 1.4$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G02
NODE=M070G02

NODE=M070G02;LINKAGE=A

NODE=M070G02;LINKAGE=AE

NODE=M070G02;LINKAGE=B

NODE=M070G02;LINKAGE=UB

$$\Gamma(K_2^*(1430)^- K^*(892)^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{100} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.6 ± 16.1 ± 0.4	8 ± 8	1,2 LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY9
NODE=M070GY9

¹ Dividing by $(1/4)^2$ to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$ and $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4$ $B(K^*(1430) \rightarrow K \pi)$.

NODE=M070GY9;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_2^*(1430)^- K^*(892)^+ + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 9.28 \pm 8.0 \pm 0.32$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY9;LINKAGE=B

$$\Gamma(K_2^*(1430)^- K^*(892)^+ + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{101} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.32 ± 2.00 ± 0.08	8 ± 8	1 LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GZ0
NODE=M070GZ0

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GZ0;LINKAGE=A

$$\Gamma(\bar{K}_2^*(1770)^0 K^*(892)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{103} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.4 ± 0.3	110 ± 14	1 AUBERT 07AK	BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M070G03
NODE=M070G03

¹ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3$.

NODE=M070G03;LINKAGE=AE

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{110} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.41 ± 0.34 OUR AVERAGE				

NODE=M070G14
NODE=M070G14

[4.48 ± 0.35 eV OUR 2024 AVERAGE]

NEW

4.39 ± 0.48 ± 0.05	181	1 LEES	12F BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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4.44 ± 0.48 ± 0.05	254 ± 23	2 SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

5.2 ± 0.7 ± 0.1	103	3 AUBERT, BE 06D	BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.19 \pm 0.23 \pm 0.07$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=B

² SHEN 09 reports $4.50 \pm 0.41 \pm 0.26$ eV from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)]$ assuming $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.6) \times 10^{-2}$, which we rescale to our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=SH

³ Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.61 \pm 0.30 \pm 0.18$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=AU

$$\Gamma(\phi \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{111} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.7 ± 0.6 OUR AVERAGE				

NODE=M070G15
NODE=M070G15

[2.8 ± 0.6 eV OUR 2024 AVERAGE]

NEW

2.73 ± 0.56 ± 0.03	45	1 LEES	12F BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.09 ± 0.86 ± 0.03	23	2 AUBERT, BE 06D	BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
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¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 1.36 \pm 0.27 \pm 0.07$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=A

² Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 1.54 \pm 0.40 \pm 0.16$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=AU

$$\Gamma(\phi 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{112} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.94 ± 0.19 OUR AVERAGE				[(0.96 ± 0.19) × 10 ⁻² keV OUR 2024 AVERAGE]
0.94 ± 0.19 ± 0.01	35	¹ AUBERT	06D BABR	10.6 e ⁺ e ⁻ → φ2(π ⁺ π ⁻) γ

NODE=M070G10
NODE=M070G10

NEW

¹ AUBERT 06D reports [$\Gamma(J/\psi(1S) \rightarrow \phi 2(\pi^+ \pi^-)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] × [B(φ(1020) → K⁺ K⁻)] = (0.47 ± 0.09 ± 0.03) × 10⁻² keV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (49.9 ± 0.5) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{113} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.6 ± 1.4 OUR AVERAGE				
4.1 ± 1.6 ± 0.4		¹ LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons
6.1 ± 2.7 ± 0.4	6	² AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → φ η γ

NODE=M070G28
NODE=M070G28

OCCUR=2

¹ LEES 23 quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi \eta) \cdot B(\phi \rightarrow K^+ K^-) \cdot B(\eta \rightarrow 3\pi^0) = 0.64 \pm 0.26 \pm 0.06$ eV.

NODE=M070G28;LINKAGE=A

² AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi \eta) \cdot B(\phi \rightarrow K^+ K^-) \cdot B(\eta \rightarrow 3\pi) = 0.84 \pm 0.37 \pm 0.05$ eV.

NODE=M070G28;LINKAGE=AU

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{117} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.42 ± 0.18 OUR AVERAGE				[1.44 ± 0.19 eV OUR 2024 AVERAGE]
1.38 ± 0.24 ± 0.02	57 ± 9	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ
1.48 ± 0.27 ± 0.09	60 ± 11	² SHEN	09 BELL	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ γ

NODE=M070G05
NODE=M070G05

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.00 ± 0.23 ± 0.01 20 ± 5 ³ AUBERT 07AK BABR 10.6 e⁺ e⁻ → π⁺ π⁻ K⁺ K⁻ γ

¹ LEES 12F reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] × [B(φ(1020) → K⁺ K⁻)] = 0.69 ± 0.11 ± 0.05 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (49.9 ± 0.5) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G05;LINKAGE=A

² Multiplied by 2/3 to take into account the φ π⁺ π⁻ mode only. Using B(φ → K⁺ K⁻) = (49.2 ± 0.6)%.

NODE=M070G05;LINKAGE=SH

³ Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] × [B(φ(1020) → K⁺ K⁻)] = 0.50 ± 0.11 ± 0.04 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (49.9 ± 0.5) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G05;LINKAGE=UB

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{118} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96 ± 0.26 OUR AVERAGE				[0.98 ± 0.26 eV OUR 2024 AVERAGE]
0.96 ± 0.26 ± 0.01	16 ± 4	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

NODE=M070G06
NODE=M070G06

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.94 ± 0.39 ± 0.01 7.0 ± 2.8 ² AUBERT 07AK BABR 10.6 e⁺ e⁻ → π⁰ π⁰ K⁺ K⁻ γ

¹ LEES 12F reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] × [B(φ(1020) → K⁺ K⁻)] = 0.48 ± 0.12 ± 0.05 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (49.9 ± 0.5) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06;LINKAGE=A

² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] × [B(φ(1020) → K⁺ K⁻)] = 0.47 ± 0.19 ± 0.05 eV which we divide by our best value B(φ(1020) → K⁺ K⁻) = (49.9 ± 0.5) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06;LINKAGE=UB

$$\Gamma(\phi f_2(1270)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{126} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.79 ± 0.32^{+0.02}_{-0.06}	61	^{1,2,3} LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

NODE=M070G07
NODE=M070G07

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.08 ± 0.73^{+0.05}_{-0.14} 44 ^{2,4} AUBERT 07AK BABR 10.6 e⁺ e⁻ → π⁺ π⁻ K⁺ K⁻ γ

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 1.51 \pm 0.25 \pm 0.10$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G07;LINKAGE=A

² Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M070G07;LINKAGE=AE

³ Using $\pi^+\pi^-$ invariant mass between 1.1 and 1.5 GeV. May include other sources such as $f_0(1370)$.

NODE=M070G07;LINKAGE=B

⁴ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 3.44 \pm 0.55 \pm 0.28$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G07;LINKAGE=UB

$\Gamma(\phi f'_2(1525)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{131}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.1±3.2±0.2	11	^{1,2} LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GZ2
NODE=M070GZ2

¹ Dividing by 1/4 to take into account $B(f'_2(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f'_2(1525) \rightarrow K\bar{K})$ and using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M070GZ2;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi f'_2(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] = 7.2 \pm 2.8 \pm 0.3$ eV which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ2;LINKAGE=B

$\Gamma(\phi K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{137}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.6 OUR AVERAGE		[4.6 ± 0.6 eV OUR 2024 AVERAGE]		

NODE=M070G09
NODE=M070G09

4.53±0.61±0.05	163	¹ LEES	12F BABR	$10.6 e^+e^- \rightarrow K^+K^- K^+K^- \gamma$
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NEW

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi K^+K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 2.26 \pm 0.26 \pm 0.16$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G09;LINKAGE=A

$\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{138}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.8 OUR AVERAGE		[3.3 ± 0.8 eV OUR 2024 AVERAGE]		

NODE=M070GZ1
NODE=M070GZ1

3.21±0.83±0.03	29	¹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
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NEW

¹ LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow \phi K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.6 \pm 0.4 \pm 0.1$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ1;LINKAGE=A

$\Gamma(f'_2(1525)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{143}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.8±1.9±0.1	16	^{1,2} LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GZ4
NODE=M070GZ4

¹ Dividing by 1/4 to take into account $B(f'_2(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f'_2(1525) \rightarrow K\bar{K})$.

NODE=M070GZ4;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow f'_2(1525)K^+K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] = 5.12 \pm 1.68 \pm 0.20$ eV which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ4;LINKAGE=B

$\Gamma(2(\pi^+\pi^-)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{164}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
303±5±18	4990	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0 \gamma$

NODE=M070G23
NODE=M070G23

$\Gamma(\pi^+\pi^-3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{166}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
100 ± 50 OUR AVERAGE		Error includes scale factor of 4.3.		

NODE=M070P53
NODE=M070P53

55 ± 16 ± 1	14k	¹ LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0 \gamma$
150.0 ± 4.0 ± 15.0	2.3k	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0 \gamma$

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-3\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] = 19.2 \pm 4.5 \pm 3.2$ eV which we divide by our best value $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}} = 0.3469 \pm 0.0034$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P53;LINKAGE=A

$$\Gamma(\pi^+\pi^-4\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{169}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
35.8±4.4±5.4	340	LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M070Q17
NODE=M070Q17

$$\Gamma(\rho^\pm\pi^\mp\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{167}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
78.0±9.0±8.0	1.2k	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0\gamma$

NODE=M070P55
NODE=M070P55

$$\Gamma(\rho^+\rho^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{168}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33.0±5.0±3.3	529	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0\gamma$

NODE=M070P56
NODE=M070P56

$$\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{170}\Gamma_5/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.1248±0.0019±0.0026	LEES	21B BABR	$10.5 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

NODE=M070G5
NODE=M070G5

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.122 ±0.005 ±0.008	AUBERT,B	04N BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
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$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{171}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±0.5±1.0	761	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M070G7
NODE=M070G7

$$\Gamma(\pi^+\pi^-\pi^0K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{172}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
107.0±4.3±6.4	768	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0\gamma$

NODE=M070G27
NODE=M070G27

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{174}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±0.9±0.4		LEES	12E BABR	$10.6 e^+e^- \rightarrow 2\pi^+2\pi^-\gamma$

NODE=M070G11
NODE=M070G11

• • • We do not use the following data for averages, fits, limits, etc. • • •

19.5±1.4±1.3	270	¹ AUBERT	05D BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\gamma$
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¹Superseded by LEES 12E.

NODE=M070G11;LINKAGE=AU

$$\Gamma(3(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{175}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.37±0.16±0.14	496	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow 3(\pi^+\pi^-)\gamma$

NODE=M070G6
NODE=M070G6

$$\Gamma(2(\pi^+\pi^-)3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{176}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
345±10±50	14k	LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q12
NODE=M070Q12

$$\Gamma(2(\pi^+\pi^-)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{178}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.1±2.4±0.1	85	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\eta\gamma$

NODE=M070G26
NODE=M070G26

¹AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-)\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 5.16 \pm 0.85 \pm 0.39$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G26;LINKAGE=AU

$$\Gamma(2(\pi^+\pi^-\pi^0)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{180}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±2.6±1.4	14k	LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q15
NODE=M070Q15

$$\Gamma(\pi^+\pi^-\pi^0\pi^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{181}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.1± 2.7 OUR AVERAGE				

NODE=M070P57
NODE=M070P57

26.1±17.9±0.3	14k	¹ LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$
12.8± 1.8±2.0	203	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0\eta\gamma$

¹LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow \pi^+\pi^-\pi^0)] = 6 \pm 4 \pm 1$ eV which we divide by our best value $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.02 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P57;LINKAGE=A

$$\Gamma(\rho^\pm \pi^\mp \pi^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{182} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.5±4.1±1.6	168	LEES	18E BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \eta \gamma$

NODE=M070P59
NODE=M070P59

$$\Gamma(K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{183} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.78±0.11±0.05	462	¹ LEES	15J BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
1.94±0.11±0.05	462	² LEES	15J BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
1.42±0.23±0.08	51	³ LEES	13Q BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$

NODE=M070G08
NODE=M070G08

OCCUR=2

¹ $\sin \phi > 0$.

² $\sin \phi < 0$.

³ Interference with non-resonant $K^+ K^-$ production not taken into account.

NODE=M070G08;LINKAGE=A
NODE=M070G08;LINKAGE=B
NODE=M070G08;LINKAGE=BA

$$\Gamma(K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{189} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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11.4±1.3±0.6	182	LEES	17A BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$
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NODE=M070G41
NODE=M070G41

$$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{190} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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6.7±0.9±0.4	106	LEES	17A BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$
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NODE=M070G42
NODE=M070G42

$$\Gamma(K_2^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{191} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.4±0.7±0.1	37	LEES	17A BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$
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NODE=M070G43
NODE=M070G43

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{192} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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37.94±0.81±1.10	3.1k	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

36.3 ±1.3 ±2.1	1.5k	¹ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
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33.6 ±2.7 ±2.7	233	² AUBERT	05D BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
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¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

NODE=M070G12
NODE=M070G12

OCCUR=2

NODE=M070G12;LINKAGE=B
NODE=M070G12;LINKAGE=AU

$$\Gamma(K^+ K^- \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{193} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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11.75±0.81±0.90	388	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

13.6 ±1.1 ±1.3	203	¹ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$
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¹ Superseded by LEES 12F.

NODE=M070G04
NODE=M070G04

NODE=M070G04;LINKAGE=A

$$\Gamma(K^+ K^- \pi^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{194} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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8.9±1.3±0.9	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
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NODE=M070Q51
NODE=M070Q51

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{195} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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29.3±2.6±2.9	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
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NODE=M070Q52
NODE=M070Q52

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{196} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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34.6±1.4±1.8	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
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NODE=M070Q53
NODE=M070Q53

$$\Gamma(K_S^0 K^\pm \rho(770)^\pm \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{197} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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16.0±4.1±1.6	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
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NODE=M070Q62
NODE=M070Q62

$$\Gamma(K_S^0 K_L^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{198} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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20.8±2.3±2.1	248	LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_L^0 \gamma$
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NODE=M070GY1
NODE=M070GY1

$$\Gamma(K_S^0 K_L^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{199} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.3±2.3±0.5	47	LEES	17A	BABR $e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \pi^0 \gamma$

NODE=M070G40
NODE=M070G40

$$\Gamma(K_S^0 K_L^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{200} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±1.8±0.4	45	LEES	17A	BABR $e^+ e^- \rightarrow K_S^0 K_L^0 \eta \gamma$

NODE=M070G35
NODE=M070G35

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{201} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±0.9±0.5	133	LEES	14H	BABR $e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY2
NODE=M070GY2

$$\Gamma(K^\mp K_S^0 \pi^\pm \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{202} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
31.7±1.9±1.8	393	LEES	17D	BABR $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G34
NODE=M070G34

$$\Gamma(K_S^0 K^\pm \pi^\mp \rho(770)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{203} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
17.3±2.1±1.7	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q55
NODE=M070Q55

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{204} \Gamma_5 / \Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.75±0.23±0.17	205	AUBERT	06D	BABR $10.6 e^+ e^- \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M070G9
NODE=M070G9

$$\Gamma(K^+ K^- \pi^+ \pi^- \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{205} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	¹ AUBERT	07AU	BABR $10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$

NODE=M070G30
NODE=M070G30

¹AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow K^+ K^- \pi^+ \pi^- \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.2 \pm 1.3 \pm 0.8$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G30;LINKAGE=A

$$\Gamma(2(K^+ K^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{206} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.00±0.33±0.29	287 ± 24	LEES	12F	BABR $10.6 e^+ e^- \rightarrow 2(K^+ K^-) \gamma$

NODE=M070G13
NODE=M070G13

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.11±0.39±0.30	156 ± 15	¹ AUBERT	07AK	BABR $10.6 e^+ e^- \rightarrow 2(K^+ K^-) \gamma$
4.0 ± 0.7 ± 0.6	38	² AUBERT	05D	BABR $10.6 e^+ e^- \rightarrow 2(K^+ K^-) \gamma$

¹Superseded by LEES 12F.

²Superseded by AUBERT 07AK.

NODE=M070G13;LINKAGE=A
NODE=M070G13;LINKAGE=A

$$\Gamma(K^+ K^- K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{207} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.4±0.1	29	LEES	14H	BABR $e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GY3
NODE=M070GY3

$$\Gamma(K_S^0 K^*(892)^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{208} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
9.45±3.15±0.90	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q56
NODE=M070Q56

$$\Gamma(K_S^0 K^*(892)^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{209} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
5.59±0.79±0.55	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q61
NODE=M070Q61

$$\Gamma(K^\mp K^*(892)^\pm \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{210} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
18.6±6.3±1.8	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q57
NODE=M070Q57

$$\Gamma(K^*(892)^\pm K^*(892)^0 \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{211} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±4.5±2.7	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q58
NODE=M070Q58

$$\Gamma(K^\mp K^*(892)^\pm \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{212} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
8.67±1.56±0.84	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{hadrons}$

NODE=M070Q60
NODE=M070Q60

$$\Gamma(K^*(892)^+ K^*(892)^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{213} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
62.1±10.8±6.30	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{hadrons}$

NODE=M070Q59
NODE=M070Q59

$$\Gamma(p\bar{p}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{214} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
11.9±0.6 OUR AVERAGE				Error includes scale factor of 1.8. See the ideogram below.
11.3±0.4±0.3	821	¹ LEES	130	BABR $e^+ e^- \rightarrow p\bar{p}\gamma$
12.9±0.4±0.4	918	² LEES	13Y	BABR $e^+ e^- \rightarrow p\bar{p}\gamma$
9.7±1.7		³ ARMSTRONG	93B E760	$\bar{p}p \rightarrow e^+ e^-$
12.0±0.6±0.5	438	⁴ AUBERT	06B	BABR $e^+ e^- \rightarrow p\bar{p}\gamma$

NODE=M070G4
NODE=M070G4

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ ISR photon reconstructed in the detector

² ISR photon undetected

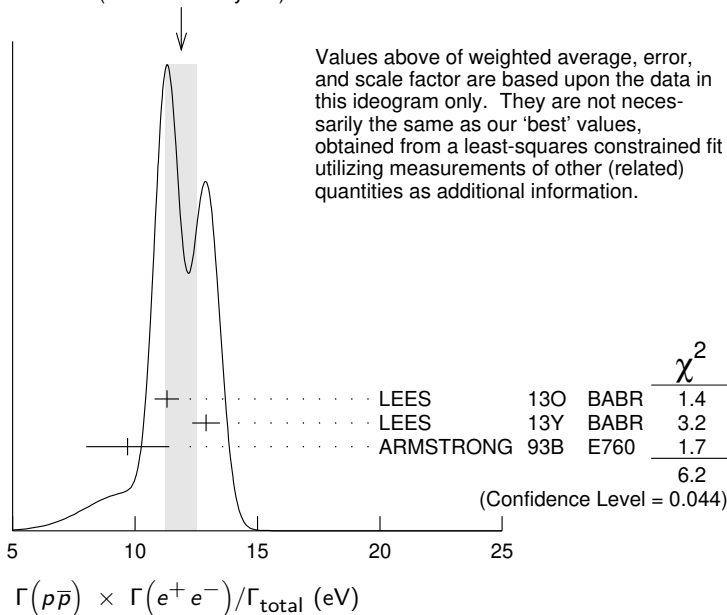
³ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.

⁴ Superseded by LEES 130

NODE=M070G4;LINKAGE=B
NODE=M070G4;LINKAGE=C

NODE=M070G;LINKAGE=A
NODE=M070G4;LINKAGE=A

WEIGHTED AVERAGE
11.9±0.6 (Error scaled by 1.8)



$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{230} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
10.7±0.9±0.7	AUBERT	07BD	BABR $10.6 e^+ e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M070G16
NODE=M070G16

$$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{241} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
6.8±1.5±0.8	GONG	23	BELL $e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

NODE=M070Q50
NODE=M070Q50

$$\Gamma(\Sigma^0 \bar{\Sigma}^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{242} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
5.2±1.5±0.6	GONG	23	BELL $e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
6.4±1.2±0.6	AUBERT	07BD	BABR $10.6 e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0 \gamma$

NODE=M070G17
NODE=M070G17

OCCUR=2

$J/\psi(1S)$ BRANCHING RATIOS

For the first four branching ratios, see also the partial widths, and (partial widths) $\times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070230

NODE=M070300

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
0.877 ± 0.005 OUR AVERAGE			
0.878 ± 0.005	BAI	95B	BES e^+e^-
0.86 ± 0.02	BOYARSKI	75	MRK1 e^+e^-

NODE=M070R3
NODE=M070R3 **$\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.1346 ± 0.0007	¹ LIAO	23	RVUE e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.135 ± 0.003	^{2,3} SETH	04	RVUE e^+e^-
0.17 ± 0.02	² BOYARSKI	75	MRK1 e^+e^-

NODE=M070R4
NODE=M070R4

¹ Using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (5.967 \pm 0.023)\%$ and $R = 2.26 \pm 0.01$ determined by a fit to data from Mark-I, DM2, BESII, KEDR, and BESIII.

² Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.

³ Using $B(J/\psi \rightarrow \ell^+\ell^-) = (5.90 \pm 0.09)\%$ from RPP-2002 and $R = 2.28 \pm 0.04$ determined by a fit to data from BAI 00 and BAI 02C. Superseded by LIAO 23.

NODE=M070R4;LINKAGE=A

NODE=M070R4;LINKAGE=C
NODE=M070R4;LINKAGE=SE **$\Gamma(ggg)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
64.1 ± 1.0	6 M	¹ BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- + \text{hadrons}$

NODE=M070S65
NODE=M070S65

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the PDG 08 values of $B(\ell^+\ell^-)$, $B(\text{virtual } \gamma \rightarrow \text{hadrons})$, and $B(\gamma\eta_c)$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S65;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.79 ± 1.05	200 k	¹ BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

NODE=M070S66
NODE=M070S66

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the value of $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S66;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$ **Γ_4/Γ_3**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7 ± 0.1 ± 0.7	6 M	BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S67
NODE=M070S67 **$\Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.971 ± 0.032 OUR AVERAGE				
5.983 ± 0.007 ± 0.037	720k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
5.945 ± 0.067 ± 0.042	15k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
5.90 ± 0.05 ± 0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
6.09 ± 0.33		BAI	95B	BES e^+e^-
5.92 ± 0.15 ± 0.20		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
6.9 ± 0.9		BOYARSKI	75	MRK1 e^+e^-

NODE=M070R1
NODE=M070R1 **$\Gamma(e^+e^-\gamma)/\Gamma_{\text{total}}$** **$\Gamma_6/\Gamma$**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8 ± 1.3 ± 0.4	¹ ARMSTRONG	96	E760 $\bar{p}p \rightarrow e^+e^-\gamma$

NODE=M070S33
NODE=M070S33

¹ For $E_\gamma > 100$ MeV.

NODE=M070S33;LINKAGE=A

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ **Γ_7/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.961 ± 0.033 OUR AVERAGE				
5.973 ± 0.007 ± 0.038	770k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
5.960 ± 0.065 ± 0.050	17k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
5.84 ± 0.06 ± 0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
6.08 ± 0.33		BAI	95B	BES e^+e^-
5.90 ± 0.15 ± 0.19		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
6.9 ± 0.9		BOYARSKI	75	MRK1 e^+e^-

NODE=M070R2
NODE=M070R2

$\Gamma(e^+e^-)/\Gamma(\mu^+\mu^-)$ Γ_5/Γ_7 NODE=M070R5
NODE=M070R5

VALUE	DOCUMENT ID	TECN	COMMENT
1.0016±0.0031 OUR AVERAGE			
1.0022±0.0044±0.0048	¹ AULCHENKO 14	KEDR	3.097 $e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
1.0017±0.0017±0.0033	² ABLIKIM 13R	BES3	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
1.002 ±0.021 ±0.013	³ ANASHIN 10	KEDR	3.097 $e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
0.997 ±0.012 ±0.006	LI 05C	CLEO	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1.011 ±0.013 ±0.016	BAI 98D	BES	$\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
1.00 ±0.07	BAI 95B	BES	e^+e^-
1.00 ±0.05	BOYARSKI 75	MRK1	e^+e^-
0.91 ±0.15	ESPOSITO 75B	FRAM	e^+e^-
0.93 ±0.10	FORD 75	SPEC	e^+e^-

¹ From 235.3k $J/\psi \rightarrow e^+e^-$ and 156.6k $J/\psi \rightarrow \mu^+\mu^-$ observed events.² Not independent of the corresponding measurements of $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$.³ Not independent of the corresponding measurements of $\Gamma(e^+e^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$.NODE=M070R5;LINKAGE=A
NODE=M070R5;LINKAGE=AB

NODE=M070R5;LINKAGE=AN

 $\Gamma(e^+e^-e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ NODE=M070Q71
NODE=M070Q71

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.48±0.31±0.45	700	¹ ABLIKIM 24L	BES3	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

¹ $B(\psi(2S) \rightarrow \pi^+\pi^- J/\psi) = (34.68 \pm 0.30)\%$ from PDG 20 was used.

NODE=M070Q71;LINKAGE=A

 $\Gamma(e^+e^- \mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_9/Γ NODE=M070Q72
NODE=M070Q72

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.53±0.22±0.13	354	¹ ABLIKIM 24L	BES3	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

¹ $B(\psi(2S) \rightarrow \pi^+\pi^- J/\psi) = (34.68 \pm 0.30)\%$ from PDG 20 was used.

NODE=M070Q72;LINKAGE=A

 $\Gamma(\mu^+\mu^- \mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ NODE=M070Q74
NODE=M070Q74

VALUE (units 10^{-7})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
11.3±1.1±0.1		452	¹ AAIJ 24AE	LHCB	$J/\psi \rightarrow \mu^+\mu^-\mu^+\mu^-$
<16	90	3.4	² ABLIKIM 24L	BES3	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
10.1 ^{+3.3} _{-2.8} ±0.1		12	³ HAYRAPETY...24A	CMS	$J/\psi \rightarrow \mu^+\mu^-\mu^+\mu^-$

¹ AAIJ 24AE reports $[\Gamma(J/\psi(1S) \rightarrow \mu^+\mu^-\mu^+\mu^-)/\Gamma_{\text{total}}] / [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = (1.89 \pm 0.17 \pm 0.09) \times 10^{-5}$ which we multiply by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Measured with $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$, $J/\psi \rightarrow \mu^+\mu^-\mu^+\mu^-$. $B(\psi(2S) \rightarrow \pi^+\pi^- J/\psi) = (34.68 \pm 0.30)\%$ from PDG 20 was used.³ HAYRAPETYAN 24A reports $[\Gamma(J/\psi(1S) \rightarrow \mu^+\mu^-\mu^+\mu^-)/\Gamma_{\text{total}}] / [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = (16.9^{+5.5}_{-4.6} \pm 0.6) \times 10^{-6}$ which we multiply by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

OCCUR=2

NODE=M070Q74;LINKAGE=D

NODE=M070Q74;LINKAGE=A

NODE=M070Q74;LINKAGE=E

 $\Gamma(\mu^+\mu^- \mu^+\mu^-)/\Gamma(\mu^+\mu^-)$ Γ_{10}/Γ_7 NODE=M070Q70
NODE=M070Q70

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
18.7±1.8 OUR AVERAGE				
18.9±1.7±0.9	452	¹ AAIJ 24AE	LHCB	$J/\psi \rightarrow \mu^+\mu^-\mu^+\mu^-$
16.9 ^{+5.5} _{-4.6} ±0.6	12	HAYRAPETY...24A	CMS	$J/\psi \rightarrow \mu^+\mu^-\mu^+\mu^-$

¹ Includes prompt production and inclusive decays of b -hadrons.

NODE=M070Q70;LINKAGE=C

HADRONIC DECAYS

NODE=M070305

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{11}/Γ NODE=M070R20
NODE=M070R20

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.88 ±0.12 OUR AVERAGE				
2.072±0.017±0.062	19.8k	¹ ANASHIN 23	KEDR	$e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$
2.18 ±0.19		^{2,3} AUBERT,B 04N	BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
2.184±0.005±0.201	220k	^{3,4} BAI 04H	BES	$e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$

Error includes scale factor of 2.6. See the ideogram below.

2.091 ± 0.021 ± 0.116	3,5	BAI	04H	BES	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.21 ± 0.20		BAI	96D	BES	$e^+ e^- \rightarrow \rho \pi$
1.42 ± 0.01 ± 0.19		COFFMAN	88	MRK3	$e^+ e^-$
1.3 ± 0.3	150	FRANKLIN	83	MRK2	$e^+ e^-$
1.6 ± 0.4	183	ALEXANDER	78	PLUT	$e^+ e^-$
1.33 ± 0.21		BRANDELIK	78B	DASP	$e^+ e^-$
1.0 ± 0.2	543	BARTEL	76	CNTR	$e^+ e^-$
1.3 ± 0.3	153	JEAN-MARIE	76	MRK1	$e^+ e^-$

OCCUR=2

¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0 \pi^0$, $J/\psi \rightarrow \rho^+ \pi^-$, $J/\psi \rightarrow \rho^- \pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.

² From the ratio of $\Gamma(e^+ e^-) B(\pi^+ \pi^- \pi^0)$ and $\Gamma(e^+ e^-) B(\mu^+ \mu^-)$ (AUBERT 04).

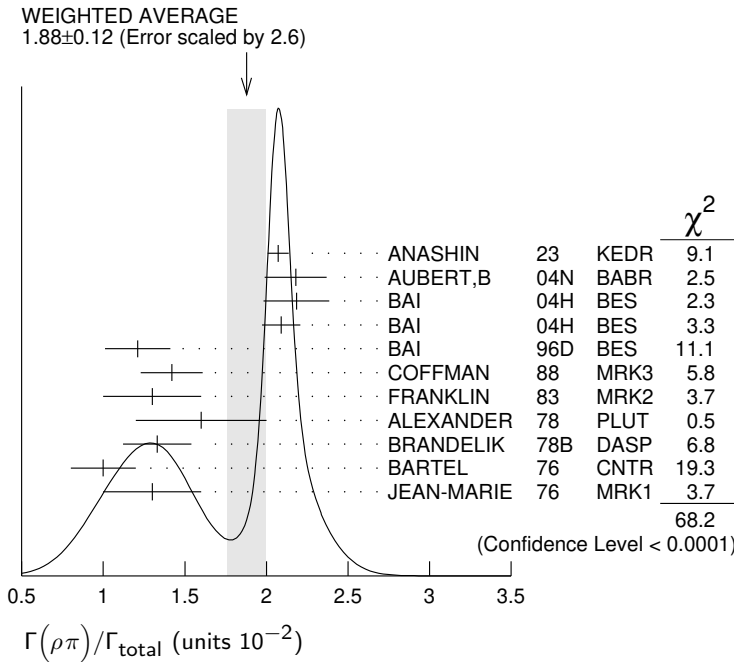
³ Not independent of their $B(\pi^+ \pi^- \pi^0)$.

⁴ From $J/\psi \rightarrow \pi^+ \pi^- \pi^0$ events directly.

⁵ Obtained comparing the rates for $\pi^+ \pi^- \pi^0$ and $\mu^+ \mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+ \mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R20;LINKAGE=A

NODE=M070R20;LINKAGE=AU
 NODE=M070R20;LINKAGE=BU
 NODE=M070R20;LINKAGE=BA
 NODE=M070R20;LINKAGE=BI



$\Gamma(\rho\pi)/\Gamma(\pi^+ \pi^- \pi^0)$

Γ_{11}/Γ_{170}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.142 ± 0.011 ± 0.026	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+ \pi^- \pi^0$
• • •		We do not use the following data for averages, fits, limits, etc. • • •		
1.331 ± 0.033	20k	² LEES	17C	BABR $J/\psi \rightarrow \pi^+ \pi^- \pi^0$

NODE=M070P18
 NODE=M070P18

OCCUR=2

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P18;LINKAGE=A
 NODE=M070P18;LINKAGE=B

$\Gamma(\rho^0 \pi^0)/\Gamma(\rho\pi)$

Γ_{12}/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.328 ± 0.005 ± 0.027	COFFMAN 88	MRK3	$e^+ e^-$
• • •	We do not use the following data for averages, fits, limits, etc. • • •		
0.35 ± 0.08	ALEXANDER 78	PLUT	$e^+ e^-$
0.32 ± 0.08	BRANDELIK 78B	DASP	$e^+ e^-$
0.39 ± 0.11	BARTEL 76	CNTR	$e^+ e^-$
0.37 ± 0.09	JEAN-MARIE 76	MRK1	$e^+ e^-$

NODE=M070R21
 NODE=M070R21

$\Gamma(a_2(1320)^0 \pi^+ \pi^- \rightarrow 2(\pi^+ \pi^-) \pi^0)/\Gamma_{total}$

Γ_{13}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.84 ± 0.08 ± 0.60	1317	ANASHIN 22	KEDR	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M070Q39
 NODE=M070Q39

$\Gamma(a_2(1320)^+ \pi^- \pi^0 + c.c \rightarrow 2(\pi^+ \pi^-) \pi^0)/\Gamma_{total}$

Γ_{14}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.67 ± 0.09 ± 0.73	1628	ANASHIN 22	KEDR	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M070Q40
 NODE=M070Q40

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**10.9±2.2 OUR AVERAGE**

11.7±0.7±2.5 7584

8.4±4.5 36

DOCUMENT ID TECN COMMENT

AUGUSTIN 89 DM2 $J/\psi \rightarrow \rho^0 \rho^\pm \pi^\mp$ VANNUCCI 77 MRK1 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0$ Γ_{15}/Γ NODE=M070R43
NODE=M070R43 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**3.78±0.68**

471

DOCUMENT ID TECN COMMENT

¹ ABLIKIM 19Q BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \eta\pi^+\pi^-$ ¹ From an energy scan of $e^+ e^- \rightarrow J/\psi \rightarrow \eta\pi^+\pi^-$ assuming PDG 16 values for $\Gamma(e^+ e^-)$, $\Gamma(\mu^+ \mu^-)$, and $\Gamma(\text{total})$. Γ_{16}/Γ NODE=M070P81
NODE=M070P81

NODE=M070P81;LINKAGE=A

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**0.193±0.023 OUR AVERAGE**

0.194±0.017±0.029 299

0.193±0.013±0.029

DOCUMENT ID TECN COMMENT

JOUSSET 90 DM2 $J/\psi \rightarrow \text{hadrons}$ COFFMAN 88 MRK3 $e^+ e^- \rightarrow \pi^+ \pi^- \eta$ Γ_{17}/Γ NODE=M070R22
NODE=M070R22 $\Gamma(\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**1.20±0.14±0.37**

471

DOCUMENT ID TECN COMMENT

ABLIKIM 15H BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$ Γ_{20}/Γ NODE=M070B12
NODE=M070B12 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE CL%

<2.52 × 10⁻⁴

90

DOCUMENT ID TECN COMMENT

ABLIKIM 10C BES2 $J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$ Γ_{21}/Γ NODE=M070S70
NODE=M070S70 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**21.8±2.2±3.4**

232 ± 23

DOCUMENT ID TECN COMMENT

ABLIKIM 08E BES2 $e^+ e^- \rightarrow J/\psi$ Γ_{23}/Γ NODE=M070S57
NODE=M070S57 $\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.15±0.13±0.22**

209

DOCUMENT ID TECN COMMENT

ABLIKIM 10C BES2 $J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$ Γ_{24}/Γ NODE=M070S69
NODE=M070S69 $\Gamma(\rho\eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS**8.1 ± 0.8 OUR AVERAGE** Error includes scale factor of 1.6.

7.90±0.19±0.49 3476

8.3 ± 3.0 ± 1.2 19

11.4 ± 1.4 ± 1.6

DOCUMENT ID TECN COMMENT

¹ ABLIKIM 17AK BES3 $J/\psi \rightarrow \pi^+ \pi^- \eta'$ JOUSSET 90 DM2 $J/\psi \rightarrow \text{hadrons}$ COFFMAN 88 MRK3 $J/\psi \rightarrow \pi^+ \pi^- \eta'$ Γ_{25}/Γ NODE=M070R23
NODE=M070R23

NODE=M070R23;LINKAGE=A

 $\Gamma(\rho^+ K^+ K^- \pi^- + \text{c.c} \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**3.53±0.16±0.81**

485

DOCUMENT ID TECN COMMENT

ANASHIN 22 KEDR $J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ Γ_{28}/Γ NODE=M070Q41
NODE=M070Q41 $\Gamma(h_1(1415)\eta' \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-5})0.08±0.01^{+0.01}_{-0.02}

DOCUMENT ID TECN COMMENT

¹ ABLIKIM 22AS BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$ ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave. Γ_{30}/Γ NODE=M070Q33
NODE=M070Q33

NODE=M070Q33;LINKAGE=A

 $\Gamma(h_1(1595)\eta' \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ VALUE (units 10^{-5})0.16±0.02^{+0.03}_{-0.01}

DOCUMENT ID TECN COMMENT

¹ ABLIKIM 22AS BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$ ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave. Γ_{31}/Γ NODE=M070Q34
NODE=M070Q34

NODE=M070Q34;LINKAGE=A

$\Gamma(\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.2±1.1	19.8k	¹ ANASHIN	23	KEDR $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070Q49
 NODE=M070Q49

¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0\pi^0$, $J/\psi \rightarrow \rho^+\pi^-$, $J/\psi \rightarrow \rho^-\pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.

NODE=M070Q49;LINKAGE=A

 $\Gamma(\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{33}/Γ_{170}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

10.9 ±1.7 ±2.7	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$
0.80±0.27	20k	² LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070P25
 NODE=M070P25

OCCUR=2

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P25;LINKAGE=A
 NODE=M070P25;LINKAGE=B

 $\Gamma(\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp)/\Gamma(K_S^0 K^\pm\pi^\mp)$ Γ_{34}/Γ_{188}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±0.8±0.6	4k	¹ LEES	17C	BABR $J/\psi \rightarrow K_S^0 K^\pm\pi^\mp$

NODE=M070P31
 NODE=M070P31

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P31;LINKAGE=A

 $\Gamma(\rho(1450)^0\pi^0 \rightarrow K^+K^-\pi^0)/\Gamma(K^+K^-\pi^0)$ Γ_{35}/Γ_{187}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±2.0±0.6	2k	¹ LEES	17C	BABR $J/\psi \rightarrow K^+K^-\pi^0$

NODE=M070P27
 NODE=M070P27

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P27;LINKAGE=A

 $\Gamma(\rho(1450)\eta'(958) \rightarrow \pi^+\pi^-\eta'(958))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.28±0.55±0.44	119	¹ ABLIKIM	17AK	BES3 $J/\psi \rightarrow \pi^+\pi^-\eta'$

NODE=M070P36
 NODE=M070P36

¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+\pi^-\eta'$.

NODE=M070P36;LINKAGE=A

 $\Gamma(\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{38}/Γ_{170}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8±2±5	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070P21
 NODE=M070P21

• • • We do not use the following data for averages, fits, limits, etc. • • •

22±6	20k	² LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$
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OCCUR=2

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P21;LINKAGE=A
 NODE=M070P21;LINKAGE=B

 $\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{40}/Γ_{170}

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4± 1±20	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070P22
 NODE=M070P22

• • • We do not use the following data for averages, fits, limits, etc. • • •

600±250	20k	² LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$
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OCCUR=2

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P22;LINKAGE=A
 NODE=M070P22;LINKAGE=B

 $\Gamma(\rho_3(1690)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{41}/Γ_{170}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.0±0.8	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$
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NODE=M070P24
 NODE=M070P24

¹ From a Dalitz plot analysis in a Veneziano model.

NODE=M070P24;LINKAGE=A

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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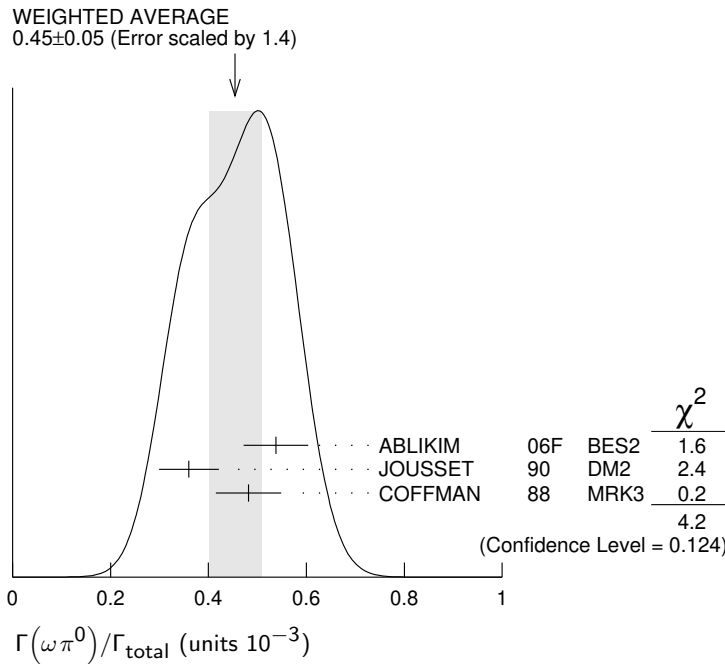
0.45 ±0.05 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

0.538±0.012±0.065	2090	¹ ABLIKIM	06F	BES2 $J/\psi \rightarrow \omega\pi^0$
0.360±0.028±0.054	222	JOUSSET	90	DM2 $J/\psi \rightarrow \text{hadrons}$
0.482±0.019±0.064		COFFMAN	88	MRK3 $e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$

NODE=M070R32
 NODE=M070R32

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R32;LINKAGE=BL



$\Gamma(\omega\pi^0 \rightarrow \pi^+ \pi^- \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_{43}/Γ_{170}

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8±3±2	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+ \pi^- \pi^0$

NODE=M070P23
NODE=M070P23

¹ From a Dalitz plot analysis in an isobar model and significance 4.9 σ .

NODE=M070P23;LINKAGE=A

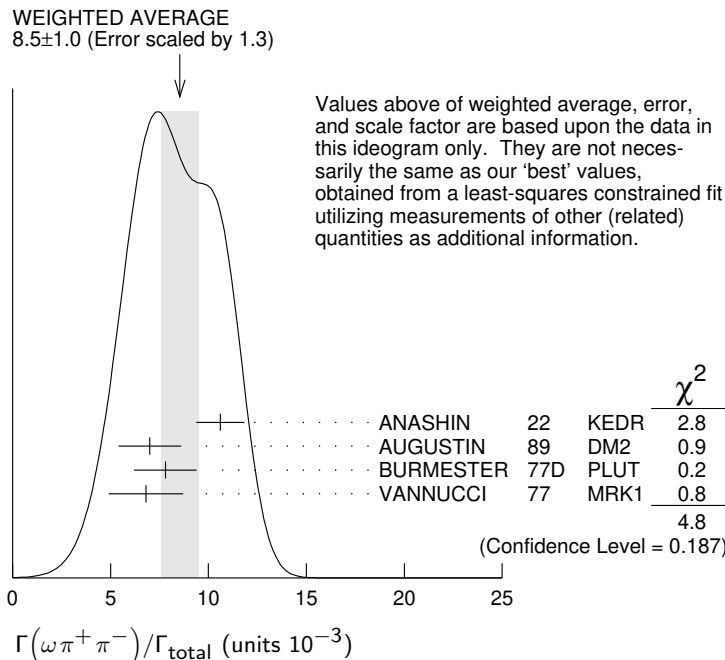
$\Gamma(\omega\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5±1.0 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
10.6±1.2±0.1	3531	¹ ANASHIN	22	KEDR $J/\psi \rightarrow 2(\pi^+ \pi^-)\pi^0$
7.0±1.6	18058	AUGUSTIN	89	DM2 $J/\psi \rightarrow 2(\pi^+ \pi^-)\pi^0$
7.8±1.6	215	BURMESTER	77D	PLUT $e^+ e^-$
6.8±1.9	348	VANNUCCI	77	MRK1 $e^+ e^- \rightarrow 2(\pi^+ \pi^-)\pi^0$

NODE=M070R24
NODE=M070R24

¹ ANASHIN 22 reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = (0.946 \pm 0.016 \pm 0.108) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R24;LINKAGE=A



$\Gamma(\omega\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{45}/Γ
$3.4 \pm 0.3 \pm 0.7$	509	AUGUSTIN	89	DM2	$J/\psi \rightarrow \pi^+\pi^-3\pi^0$

NODE=M070S26
 NODE=M070S26

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{47}/Γ
4.3 ± 0.6 OUR AVERAGE					
$4.3 \pm 0.2 \pm 0.6$	5860	AUGUSTIN	89	DM2	e^+e^-
4.0 ± 1.6	70	BURMESTER	77D	PLUT	e^+e^-

NODE=M070R28
 NODE=M070R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.9 ± 0.8	81	VANNUCCI	77	MRK1	$e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$
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 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{48}/Γ
1.74 ± 0.20 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.	
2.352 ± 0.273	5k	¹ ABLIKIM	06F	BES2	$J/\psi \rightarrow \omega\eta$
$1.44 \pm 0.40 \pm 0.14$	13	² AUBERT	06D	BABR	$10.6 e^+e^- \rightarrow \omega\eta\gamma$
$1.43 \pm 0.10 \pm 0.21$	378	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
$1.71 \pm 0.08 \pm 0.20$		COFFMAN	88	MRK3	$e^+e^- \rightarrow 3\pi\eta$

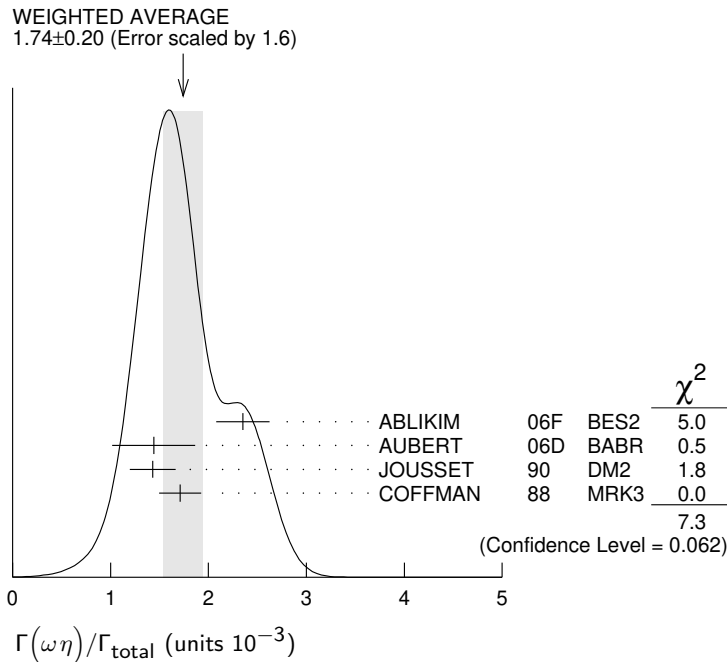
NODE=M070R30
 NODE=M070R30

¹ Using $B(\eta \rightarrow 2\gamma) = (39.43 \pm 0.26)\%$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = 22.6 \pm 0.4\%$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = 4.68 \pm 0.11\%$, and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R30;LINKAGE=BL

² Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R30;LINKAGE=EE

 $\Gamma(\omega\pi^+\pi^+\pi^-\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{51}/Γ
85 ± 34	140	VANNUCCI	77	MRK1	$e^+e^- \rightarrow 3(\pi^+\pi^-)\pi^0$

NODE=M070R26
 NODE=M070R26

 $\Gamma(\omega\eta'\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{53}/Γ
$1.12 \pm 0.02 \pm 0.13$	14k	¹ ABLIKIM	19AC	BES3	$J/\psi \rightarrow \omega\eta'\pi^+\pi^-$

NODE=M070P83
 NODE=M070P83

¹ Using the decays $\omega \rightarrow \pi^+\pi^-\pi^0$ and $\eta' \rightarrow \eta\pi^+\pi^-$.

NODE=M070P83;LINKAGE=A

 $\Gamma(\omega\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{54}/Γ
1.89 ± 0.18 OUR AVERAGE					
$2.08 \pm 0.30 \pm 0.14$	137	¹ ABLIKIM	17AK	BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'$
2.26 ± 0.43	218	² ABLIKIM	06F	BES2	$J/\psi \rightarrow \omega\eta'$
$1.8 \pm 1.0 \pm 0.8$	6	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
$1.66 \pm 0.17 \pm 0.19$		COFFMAN	88	MRK3	$e^+e^- \rightarrow 3\pi\eta'$

NODE=M070R31
 NODE=M070R31

¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+ \pi^- \eta'$.

² Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = (44.3 \pm 1.5)\%$, $B(\eta' \rightarrow \pi^+ \pi^- \gamma) = 29.5 \pm 1.0\%$, $B(\eta \rightarrow 2\gamma) = 39.43 \pm 0.26\%$, and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R31;LINKAGE=A
NODE=M070R31;LINKAGE=BL

$\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.41±0.27±0.47	¹ AUGUSTIN	89	DM2 $J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M070S27
NODE=M070S27

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070S27;LINKAGE=K

$\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.8±1.1±0.3	^{1,2} FALVARD	88	DM2 $J/\psi \rightarrow \text{hadrons}$

NODE=M070S25
NODE=M070S25

¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

² Addition of $f_0(1710) \rightarrow K^+ K^-$ and $f_0(1710) \rightarrow K^0 \bar{K}^0$ branching ratios.

NODE=M070S25;LINKAGE=F
NODE=M070S25;LINKAGE=G

$\Gamma(\omega f_1(1420))/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.8^{+1.9}_{-1.6}±1.7	111 ⁺³¹ ₋₂₆	BECKER	87	MRK3 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S5
NODE=M070S5

$\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10⁻⁴	90	¹ VANNUCCI	77	MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 K^+ K^-$

NODE=M070R29
NODE=M070R29

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.8 × 10 ⁻⁴	90	¹ FALVARD	88	DM2 $J/\psi \rightarrow \text{hadrons}$
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¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.713$.

NODE=M070R29;LINKAGE=C

$\Gamma(\omega X(1835) \rightarrow \omega p \bar{p})/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.9 × 10⁻⁶	95	ABLIKIM	13P	BES3 $J/\psi \rightarrow \gamma \pi^0 p \bar{p}$

NODE=M070S81
NODE=M070S81

$\Gamma(\omega X(1835), X \rightarrow \eta' \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
<6.2 × 10⁻⁵	¹ ABLIKIM	19AC	BES3 $J/\psi \rightarrow \omega \eta' \pi^+ \pi^-$

NODE=M070P84
NODE=M070P84

¹ Using the decays $\omega \rightarrow \pi^+ \pi^- \pi^0$ and $\eta' \rightarrow \eta \pi^+ \pi^-$.

NODE=M070P84;LINKAGE=A

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.52±0.30±0.01	276	¹ ANASHIN	22	KEDR $J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M070Q38
NODE=M070Q38

¹ ANASHIN 22 reports $[\Gamma(J/\psi(1S) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = (0.136 \pm 0.008 \pm 0.026) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q38;LINKAGE=A

$\Gamma(\omega K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.33±0.02±0.12	ABLIKIM	24BQ	BES3 $e^+ e^- \rightarrow J/\psi(1S)$

NODE=M070Q78
NODE=M070Q78

$\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
34 ± 5 OUR AVERAGE				
37.7±0.8±5.8	1972 ± 41	ABLIKIM	08E	BES2 $e^+ e^- \rightarrow J/\psi$
29.5±1.4±7.0	879 ± 41	BECKER	87	MRK3 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S1
NODE=M070S1

$\Gamma(\omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19 ± 4 OUR AVERAGE				
19.8± 2.1±3.9		¹ FALVARD	88	DM2 $J/\psi \rightarrow \text{hadrons}$
16 ± 10	22	FELDMAN	77	MRK1 $e^+ e^-$

NODE=M070R27
NODE=M070R27

¹ Addition of $\omega K^+ K^-$ and $\omega K^0 \bar{K}^0$ branching ratios.

NODE=M070R27;LINKAGE=B

$\Gamma(\omega K^*(892)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ± 9 OUR AVERAGE				
62.0 ± 6.8 ± 10.6	899 ± 98	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp$
65.3 ± 10.2 ± 13.5	176 ± 28	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
53 ± 14 ± 14	530 ± 140	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S2
NODE=M070S2

OCCUR=2

 $\Gamma(\eta' K^{*\pm} K^\mp)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.48 ± 0.13 OUR AVERAGE			
1.50 ± 0.02 ± 0.19	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$
1.47 ± 0.03 ± 0.17	² ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K^+ K^- \pi^0$.			
² From $\eta' K_S^0 K^\pm \pi^\mp$.			

NODE=M070P48
NODE=M070P48

OCCUR=2

NODE=M070P48;LINKAGE=A
NODE=M070P48;LINKAGE=B $\Gamma(\eta' K^{*0} \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.66 ± 0.03 ± 0.21	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K_S^0 K^\pm \pi^\mp$.			

NODE=M070P49
NODE=M070P49

NODE=M070P49;LINKAGE=A

 $\Gamma(\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.16 ± 0.12 ± 0.29	1.1k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K_S^0 K^\pm \pi^\mp$.				

NODE=M070P52
NODE=M070P52

NODE=M070P52;LINKAGE=A

 $\Gamma(\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.51 ± 0.09 ± 0.21	1.0k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K^+ K^- \pi^0$.				

NODE=M070P44
NODE=M070P44

NODE=M070P44;LINKAGE=A

 $\Gamma(\eta' h_1(1415) \rightarrow \gamma \eta' \eta')/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
4.69 ± 0.80^{+0.74}_{-1.82}	¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.			

NODE=M070Q28
NODE=M070Q28

NODE=M070Q28;LINKAGE=A

 $\Gamma(\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$ Γ_{72}/Γ_{188}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
90.5 ± 0.9 ± 3.8	4k	¹ LEES	17C BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
¹ From a Dalitz plot analysis in an isobar model.				

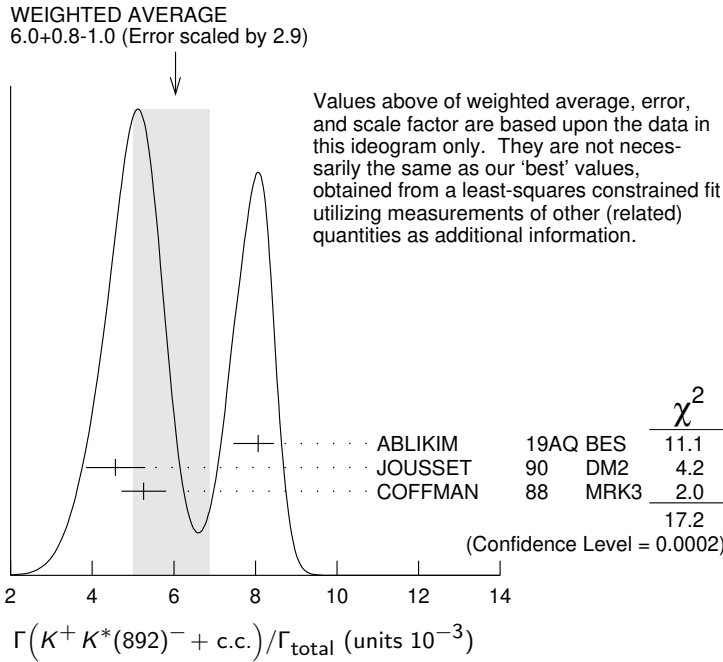
NODE=M070P30
NODE=M070P30

NODE=M070P30;LINKAGE=A

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0^{+0.8}_{-1.0} OUR AVERAGE				Error includes scale factor of 2.9. See the ideogram below.
8.07 ± 0.04 ^{+0.38} _{-0.61}	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
4.57 ± 0.17 ± 0.70	2285	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
5.26 ± 0.13 ± 0.53		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$, $K^+ K^- \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.6 ± 0.6	24	FRANKLIN	83 MRK2	$J/\psi \rightarrow K^+ K^- \pi^0$
3.2 ± 0.6	48	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
4.1 ± 1.2	39	BRAUNSCH...	76 DASP	$J/\psi \rightarrow K^\pm X$

NODE=M070S15
NODE=M070S15



$\Gamma(K^+ K^*(892)^- + c.c. \rightarrow K^+ K^- \pi^0) / \Gamma_{total}$ Γ_{74} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.69 ± 0.01^{+0.13}_{-0.20}	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P79
NODE=M070P79

$\Gamma(K^+ K^*(892)^- + c.c. \rightarrow K^+ K^- \pi^0) / \Gamma(K^+ K^- \pi^0)$ $\Gamma_{74} / \Gamma_{187}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
92.4 ± 1.5 ± 3.4	2k	¹ LEES	17C BABR	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P26
NODE=M070P26

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P26;LINKAGE=A

$\Gamma(K^0 \bar{K}^*(892)^0 + c.c.) / \Gamma_{total}$ Γ_{76} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE				
3.96 ± 0.15 ± 0.60	1192	JOUSSET 90 DM2		$J/\psi \rightarrow \text{hadrons}$
4.33 ± 0.12 ± 0.45		COFFMAN 88 MRK3		$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.7 ± 0.6	45	VANNUCCI 77 MRK1		$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$

NODE=M070S16
NODE=M070S16

$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + c.c.) / \Gamma_{total}$ Γ_{78} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
5.73 ± 0.14 ± 0.82	¹ ANASHIN 22 KEDR		$J/\psi \rightarrow K^+ K^- \pi^+ \pi^-$
seen	² ABLIKIM 06C BES2		$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$

NODE=M070S52
NODE=M070S52

¹ Obtained from $J/\psi \rightarrow K^*(892) K^- \pi^+ + c.c. \rightarrow K^+ K^- \pi^+ \pi^-$ taking the value 2/3 for the probability of the $K^*(892)^0 \rightarrow K^+ \pi^-$ decay.

NODE=M070S52;LINKAGE=A

² A $K_0^*(700)$ is observed by ABLIKIM 06C in the $K^+ \pi^-$ mass spectrum of the $\bar{K}^*(892)^0 K^+ \pi^-$ final state against the $\bar{K}^*(892)$. A corresponding branching fraction of the $J/\psi(1S)$ is not presented.

NODE=M070S52;LINKAGE=AB

$\Gamma(K^*(892)^0 K^- \pi^+ + c.c. \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{total}$ Γ_{82} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.81 ± 0.10 ± 0.54	1559	ANASHIN 22 KEDR		$J/\psi \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M070Q42
NODE=M070Q42

$\Gamma(K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{total}$ Γ_{83} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
6.28^{+0.16+0.59}_{-0.17-0.52}	ABLIKIM 18AA BES3		$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P71
NODE=M070P71

$\Gamma(K^*(892)^\pm K^*(700)^\mp) / \Gamma_{total}$ Γ_{85} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09 ± 0.18^{+0.94}_{-0.54}	655	ABLIKIM 10E BES2		$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S74
NODE=M070S74

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<5	90	VANNUCCI	77	MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$
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NODE=M070R46
NODE=M070R46 $\Gamma(K^*(892)^\pm K^*(892)^\mp)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$1.00 \pm 0.19^{+0.11}_{-0.32}$	323	ABLIKIM	10E	BES2 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
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NODE=M070S73
NODE=M070S73 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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$3.8 \pm 0.8 \pm 1.2$	¹ BAI	99C	BES $e^+ e^-$
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¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$ NODE=M070S35
NODE=M070S35

NODE=M070S35;LINKAGE=M3

 $\Gamma(K^*(1410) \bar{K} + c.c. \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$ Γ_{90}/Γ_{187}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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$2.3 \pm 1.1 \pm 0.7$	2k	¹ LEES	17C	BABR $J/\psi \rightarrow K^+ K^- \pi^0$
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NODE=M070P28
NODE=M070P28¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P28;LINKAGE=A

 $\Gamma(K^*(1410) \bar{K} + c.c. \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$ Γ_{91}/Γ_{188}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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$1.5 \pm 0.5 \pm 0.9$	4k	¹ LEES	17C	BABR $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
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NODE=M070P32
NODE=M070P32¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P32;LINKAGE=A

 $\Gamma(K_2^*(1430) \bar{K} + c.c. \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$ Γ_{93}/Γ_{187}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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$3.5 \pm 1.3 \pm 0.9$	2k	¹ LEES	17C	BABR $J/\psi \rightarrow K^+ K^- \pi^0$
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NODE=M070P29
NODE=M070P29¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P29;LINKAGE=A

 $\Gamma(K_2^*(1430) \bar{K} + c.c. \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$ Γ_{94}/Γ_{188}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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$7.1 \pm 1.3 \pm 1.2$	4k	¹ LEES	17C	BABR $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
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NODE=M070P33
NODE=M070P33¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P33;LINKAGE=A

 $\Gamma(\bar{K}_2^*(1430) K + c.c.)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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< 40×10^{-4}	90	VANNUCCI	77	MRK1 $e^+ e^- \rightarrow K^0 \bar{K}_2^{*0}$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 66×10^{-4}	90	BRAUNSCH...	76	DASP $e^+ e^- \rightarrow K^\pm \bar{K}_2^{*\mp}$
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NODE=M070R45
NODE=M070R45 $\Gamma(K_2^*(1430)^+ K^- + c.c. \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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$2.69 \pm 0.04^{+0.25}_{-0.19}$	183k	ABLIKIM	19AQ	BES $J/\psi \rightarrow K^+ K^- \pi^0$
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NODE=M070P76
NODE=M070P76 $\Gamma(K_2^*(1430)^0 K^- \pi^+ + c.c. \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$2.65 \pm 0.80 \pm 0.44$	1094	ANASHIN	22	KEDR $J/\psi \rightarrow K^+ K^- \pi^+ \pi^-$
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NODE=M070Q43
NODE=M070Q43 $\Gamma(\bar{K}_2^*(1430)^0 K^*(892)^0 + c.c.)/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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6.7 ± 2.6	40	VANNUCCI	77	MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M070R48
NODE=M070R48 $\Gamma(K_2^*(1430)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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< 29×10^{-4}	90	VANNUCCI	77	MRK1 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$
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NODE=M070R47
NODE=M070R47 $\Gamma(K_2^*(1980)^+ K^- + c.c. \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{104}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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$1.1 \pm 0.1^{+0.6}_{-0.1}$	183k	ABLIKIM	19AQ	BES $J/\psi \rightarrow K^+ K^- \pi^0$
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NODE=M070P77
NODE=M070P77

$\Gamma(K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.2 \pm 0.7^{+2.8}_{-1.4}$	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P78
 NODE=M070P78

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{106}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.0 \times 10^{-3}$	90	¹ BAI	99C BES	$e^+ e^-$

NODE=M070S34
 NODE=M070S34

¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$

NODE=M070S34;LINKAGE=M2

 $\Gamma(K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{107}/Γ

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
$8.54^{+1.07+2.35}_{-1.20-2.13}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P72
 NODE=M070P72

 $\Gamma(a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{108}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 43 \times 10^{-4}$	90	BRAUNSCH... 76	DASP	$e^+ e^-$

NODE=M070R42
 NODE=M070R42

 $\Gamma(\phi \pi^0)/\Gamma_{\text{total}}$ Γ_{109}/Γ

The two different fit values of ABLIKIM 15K below have the same statistical significance of 6.4σ and cannot be distinguished at this moment.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.94 \pm 0.16 \pm 0.16$		0.8k	¹ ABLIKIM	15K BES3	$e^+ e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$
$0.124 \pm 0.033 \pm 0.030$		35 ± 9	² ABLIKIM	15K BES3	$e^+ e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$

NODE=M070R33

NODE=M070R33

NODE=M070R33

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6.4	90	³ ABLIKIM	05B BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \gamma \gamma$
< 6.8	90	COFFMAN	88 MRK3	$e^+ e^- \rightarrow K^+ K^- \pi^0$

¹ Corresponding to one of the two fit solutions with $\delta = (-95.9 \pm 1.5)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

NODE=M070R33;LINKAGE=A

² Corresponding to one of the two fit solutions with $\delta = (-152.1 \pm 7.7)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

NODE=M070R33;LINKAGE=C

³ Superseded by ABLIKIM 15K.

NODE=M070R33;LINKAGE=B

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.94 ± 0.15 OUR AVERAGE				Error includes scale factor of 1.7.
$1.09 \pm 0.02 \pm 0.13$		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$0.78 \pm 0.03 \pm 0.12$		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
2.1 ± 0.9	23	FELDMAN	77 MRK1	$e^+ e^-$

NODE=M070R34
 NODE=M070R34

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$16.0 \pm 1.0 \pm 3.0$	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070R35
 NODE=M070R35

 $\Gamma(\phi \eta)/\Gamma_{\text{total}}$ Γ_{113}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.74 ± 0.06 OUR AVERAGE				Error includes scale factor of 1.2.
$0.71 \pm 0.10 \pm 0.05$	99 ± 14	¹ ZHU	23 BELL	$e^+ e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$
$0.898 \pm 0.024 \pm 0.089$		ABLIKIM	05B BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \text{hadr}$
$0.64 \pm 0.04 \pm 0.11$	346	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$0.661 \pm 0.045 \pm 0.078$		COFFMAN	88 MRK3	$e^+ e^- \rightarrow K^+ K^- \eta$

NODE=M070R37
 NODE=M070R37

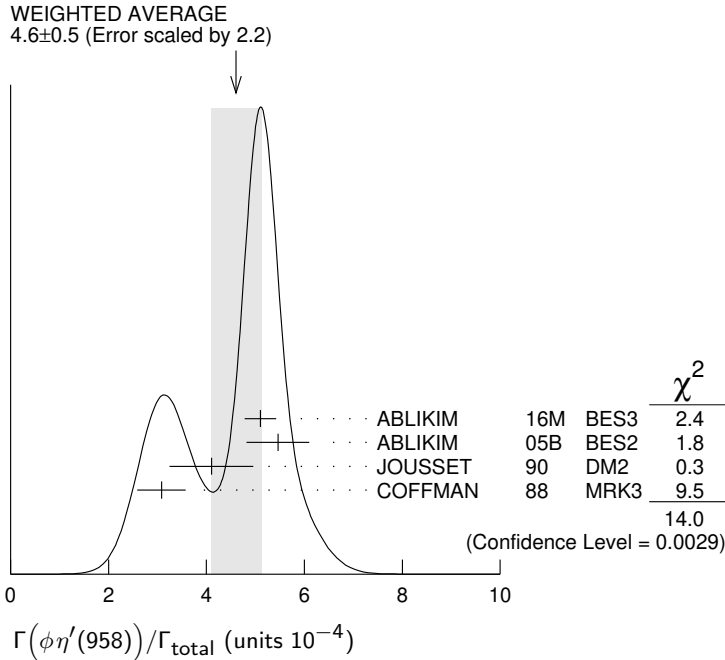
¹ From a fit to the combined $\phi \eta$ invariant mass spectrum with a Gaussian function for the J/ψ signals and a second-order polynomial function for the backgrounds.

NODE=M070R37;LINKAGE=A

$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE (units 10^{-4})	CL% EVTS	DOCUMENT ID	TECN	COMMENT
4.6 ± 0.5 OUR AVERAGE		Error includes scale factor of 2.2. See the ideogram below.		
5.10 ± 0.03 ± 0.32	31k	ABLIKIM	16M BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
5.46 ± 0.31 ± 0.56		ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
4.1 ± 0.3 ± 0.8	167	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
3.08 ± 0.34 ± 0.36		COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 13	90	VANNUCCI	77 MRK1	e^+e^-

NODE=M070R38
 NODE=M070R38

 $\Gamma(\phi\eta\eta')/\Gamma_{\text{total}}$ Γ_{115}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.32 ± 0.06 ± 0.16	2.2k	¹ ABLIKIM	19AN BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

NODE=M070P85
 NODE=M070P85

¹ Including contributions from intermediate resonances. Evidence for an intermediate resonance at $M \approx 2$ GeV and $\Gamma \approx 150$ MeV decaying to $\phi\eta'$ with $J^P = 1^+$ or $J^P = 1^-$, and $B(J/\psi \rightarrow \eta X) \times B(X \rightarrow \phi\eta') \approx 10^{-4}$.

NODE=M070P85;LINKAGE=A

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.9 OUR AVERAGE		Error includes scale factor of 1.9.		
4.6 ± 0.4 ± 0.8		¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
2.6 ± 0.6	50	¹ GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$

NODE=M070R41
 NODE=M070R41

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070R41;LINKAGE=A

 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
4.50 ± 0.80 ± 0.61	355	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$

NODE=M070S97
 NODE=M070S97

 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\rho^0\pi^0)/\Gamma_{\text{total}}$ Γ_{120}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.67 ± 0.50 ± 0.24	70	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$

NODE=M070S98
 NODE=M070S98

 $\Gamma(\phi f_0(980)\eta \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{121}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.23 ± 0.75 ± 0.73	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta\phi f_0(980)$

NODE=M070R08
 NODE=M070R08

$\Gamma(\phi a_0(980)^0 \rightarrow \phi \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{122} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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NODE=M070S75
NODE=M070S75

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.24 \pm 0.20^{+0.52}_{-0.22}$	1 ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
$2.74 \pm 0.13^{+0.15}_{-0.16}$	2 ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
4.37 ± 1.35	3,4 ABLIKIM	18D BES3	$J/\psi \rightarrow \phi \eta \pi^0$
$5.0 \pm 2.7 \pm 2.5$	5 ABLIKIM	11D BES3	$J/\psi \rightarrow \phi \eta \pi^0$

OCCUR=2

¹ $J/\psi \rightarrow \phi a_0(980)$ electromagnetic decay.

² $J/\psi \rightarrow \phi f_0(980)$, $\phi a_0(980)$ mixing.

³ Assuming constructive interference between $a_0(980) - f_0(980)$ mixing and electromagnetic decay. Destructive interference gives a value of $(4.93 \pm 1.77) \times 10^{-6}$ for this branching fraction.

⁴ Superseded by ABLIKIM 24CB.

⁵ Assuming $a_0(980) - f_0(980)$ mixing and isospin breaking via γ^* and $K^* K$ loops.

NODE=M070S75;LINKAGE=B
NODE=M070S75;LINKAGE=C
NODE=M070S75;LINKAGE=A

NODE=M070S75;LINKAGE=D
NODE=M070S75;LINKAGE=AB

 $\Gamma(\phi(1680)^0 \pi^0 \rightarrow \phi \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{123} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q80
NODE=M070Q80

$6.66 \pm 0.26^{+1.1}_{-1.0}$	ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
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 $\Gamma(\chi(2000)^0 \pi^0 \rightarrow \phi \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{124} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q81
NODE=M070Q81

$1.70 \pm 0.19^{+0.48}_{-0.13}$	ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
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 $\Gamma(h_1(1900)^0 \pi^0 \rightarrow \phi \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{125} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q82
NODE=M070Q82

$8.44 \pm 0.35^{+1.4}_{-1.2}$	ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$
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 $\Gamma(\phi f_2(1270)) / \Gamma_{\text{total}}$ Γ_{126} / Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070R39
NODE=M070R39

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.45	90	FALVARD	88	DM2	$J/\psi \rightarrow \text{hadrons}$
< 0.37	90	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

 $\Gamma(\phi f_1(1285)) / \Gamma_{\text{total}}$ Γ_{127} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S6
NODE=M070S6

2.6 ± 0.5 OUR AVERAGE

$3.4 \pm 1.8 \pm 1.5$	1.1k	1 ABLIKIM	15H	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$
$3.2 \pm 0.6 \pm 0.4$		JOUSSET	90	DM2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-)$
$2.1 \pm 0.5 \pm 0.4$	25	2 JOUSSET	90	DM2	$J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.6 \pm 0.2 \pm 0.1$	16	BECKER	87	MRK3	$J/\psi \rightarrow \phi K \bar{K} \pi$
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¹ ABLIKIM 15H reports $[\Gamma(J/\psi(15) \rightarrow \phi f_1(1285)) / \Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow \eta \pi^+ \pi^-)] = (1.20 \pm 0.6 \pm 0.14) \times 10^{-4}$ which we divide by our best value $B(f_1(1285) \rightarrow \eta \pi^+ \pi^-) = (35 \pm 15) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070S6;LINKAGE=A

² We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.

NODE=M070S6;LINKAGE=Q

 $\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{128} / Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S99
NODE=M070S99

$9.36 \pm 2.31 \pm 1.54$	78	ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
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 $\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0) / \Gamma_{\text{total}}$ Γ_{129} / Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S00
NODE=M070S00

$2.08 \pm 1.63 \pm 1.47$	9	ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
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$\Gamma(\phi\eta(1405) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.01 ± 0.58 ± 0.82		172	1 ABLIKIM	15H BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$
< 17	90		2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ With 3.6 σ significance.

² Includes unknown branching fraction $\eta(1405) \rightarrow \eta\pi\pi$.

NODE=M070S23
NODE=M070S23

NODE=M070S23;LINKAGE=B
NODE=M070S23;LINKAGE=A

$\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8 ± 4 OUR AVERAGE		Error includes scale factor of 2.7.		
12.3 ± 0.6 ± 2.0		1,2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
4.8 ± 1.8	46	1 GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$

¹ Re-evaluated using $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.

² Including interference with $f_0(1710)$.

NODE=M070R40
NODE=M070R40

NODE=M070R40;LINKAGE=B
NODE=M070R40;LINKAGE=C

$\Gamma(\phi X(1835) \rightarrow \phi p\bar{p})/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1 × 10⁻⁷	90	1 ABLIKIM	16K BES3	$J/\psi \rightarrow p\bar{p}K_S^0K_L^0$ $p\bar{p}K^+K^-$

¹ Upper limit applies to any $p\bar{p}$ mass enhancement near threshold.

NODE=M070P00
NODE=M070P00

OCCUR=2

NODE=M070P00;LINKAGE=A

$\Gamma(\phi X(1835) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.8 × 10⁻⁴	90	ABLIKIM	15H BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$

NODE=M070B10
NODE=M070B10

$\Gamma(\phi X(1870) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{134}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 6.13 × 10⁻⁵	90	ABLIKIM	15H BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$

NODE=M070B11
NODE=M070B11

$\Gamma(\phi K\bar{K})/\Gamma_{\text{total}}$ Γ_{135}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
17.7 ± 1.6 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
16.6 ± 1.9 ± 1.2	163 ± 19	LEES	12F BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
21.4 ± 0.4 ± 2.2		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
48 ⁺²⁰ ₋₁₆ ± 6	9.0 ^{+3.7} _{-3.0}	1,2 HUANG	03 BELL	$B^+ \rightarrow (\phi K^+K^-) K^+$
14.6 ± 0.8 ± 2.1		3 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
18 ± 8	14	FELDMAN	77 MRK1	e^+e^-

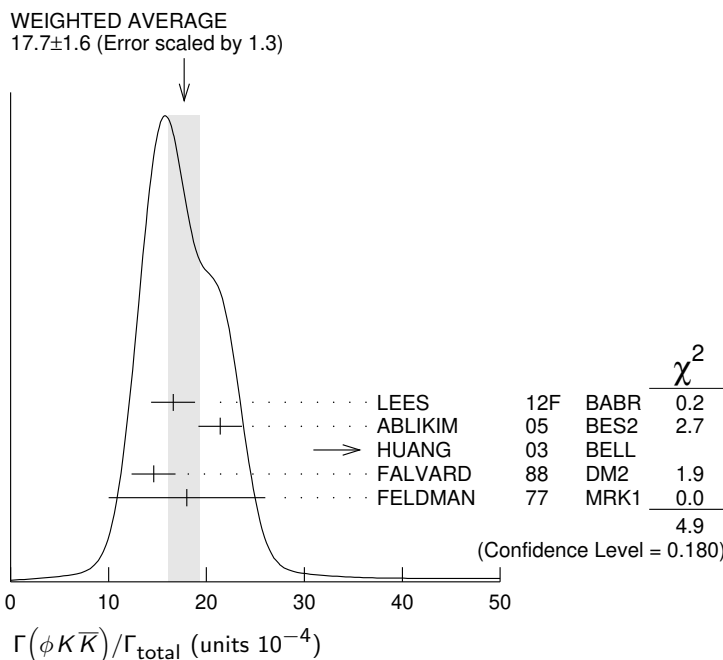
¹ We have multiplied K^+K^- measurement by 2 to obtain $K\bar{K}$.

² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³ Addition of ϕK^+K^- and $\phi K^0\bar{K}^0$ branching ratios.

NODE=M070R36
NODE=M070R36

NODE=M070R36;LINKAGE=AA
NODE=M070R36;LINKAGE=CC
NODE=M070R36;LINKAGE=A



$\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K})/\Gamma_{\text{total}}$ Γ_{136}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6±0.2±0.6	1,2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S24
 NODE=M070S24

¹ Including interference with $f_2'(1525)$.

² Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

NODE=M070S24;LINKAGE=D
 NODE=M070S24;LINKAGE=E

 $\Gamma(\phi K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{139}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.2±0.8 OUR AVERAGE				
7.4±0.6±1.4	227 ± 19	ABLIKIM	08E BES2	$e^+ e^- \rightarrow J/\psi$
7.4±0.9±1.1		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
7 ± 0.6±1.0	163 ± 15	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S3
 NODE=M070S3

 $\Gamma(\phi K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{140}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.8±2.3 OUR AVERAGE				
20.8±2.7±3.9	195 ± 25	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K_S^0 K^\pm \pi^\mp$
29.6±3.7±4.7	238 ± 30	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K^+ K^- \pi^0$
20.7±2.4±3.0		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
20 ± 3 ± 3	155 ± 20	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S4
 NODE=M070S4

OCCUR=2

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{141}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
30±5 OUR AVERAGE				
31±6	4600	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
29±7	87	BURMESTER	77D PLUT	$e^+ e^-$

NODE=M070R49
 NODE=M070R49

 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{142}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
23±3±5	229	AUGUSTIN	89 DM2	$e^+ e^-$

NODE=M070S28
 NODE=M070S28

 $\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1 × 10⁻³	90	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S14
 NODE=M070S14

 $\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}}$ Γ_{145}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.58±0.23±0.40	332	EATON	84 MRK2	$e^+ e^-$

NODE=M070R70
 NODE=M070R70

 $\Gamma(\Delta(1232)^{++} \bar{\Delta}(1232)^{--})/\Gamma_{\text{total}}$ Γ_{146}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10±0.09±0.28	233	EATON	84 MRK2	$e^+ e^-$

NODE=M070R66
 NODE=M070R66

 $\Gamma(\Sigma(1385)^0 p K^-)/\Gamma_{\text{total}}$ Γ_{147}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.51±0.26±0.18	89	EATON	84 MRK2	$e^+ e^-$

NODE=M070R74
 NODE=M070R74

 $\Gamma(\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.82 × 10⁻⁵	90	ABLIKIM	13F BES3	$J/\psi \rightarrow p \bar{p} \pi^+ \pi^- \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.2 × 10 ⁻³	90	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S13
 NODE=M070S13

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.07 OUR AVERAGE				
0.30±0.03±0.08	74 ± 8	HENRARD	87 DM2	$e^+ e^-$
0.29±0.11±0.10	26	EATON	84 MRK2	$e^+ e^-$

NODE=M070R68
 NODE=M070R68

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{150}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.33±0.08 OUR AVERAGE				
0.34±0.04±0.08	77	HENRARD	87 DM2	$e^+ e^-$
0.31±0.11±0.11	28	EATON	84 MRK2	$e^+ e^-$

NODE=M070Q47
 NODE=M070Q47

$$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{151}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.08 ± 0.06	OUR AVERAGE			
1.096 ± 0.012 ± 0.071	43k	ABLIKIM	16L BES3	$e^+ e^-$
1.23 ± 0.07 ± 0.30	0.8k	ABLIKIM	12P BES2	$e^+ e^-$
1.00 ± 0.04 ± 0.21	0.6k	HENRARD	87 DM2	$e^+ e^-$
0.86 ± 0.18 ± 0.22	56	EATON	84 MRK2	$e^+ e^-$

NODE=M070R67
NODE=M070R67

$$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{152}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.25 ± 0.07	OUR AVERAGE			
1.258 ± 0.014 ± 0.078	53k	ABLIKIM	16L BES3	$e^+ e^-$
1.50 ± 0.08 ± 0.38	1k	ABLIKIM	12P BES2	$e^+ e^-$
1.19 ± 0.04 ± 0.25	0.7k	HENRARD	87 DM2	$e^+ e^-$
1.03 ± 0.24 ± 0.25	68	EATON	84 MRK2	$e^+ e^-$

NODE=M070Q48
NODE=M070Q48

$$\Gamma(\Sigma(1385)^0 \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}} \quad \Gamma_{153}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.071 ± 0.009 ± 0.082	103k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow J/\psi \rightarrow$ hadrons

NODE=M070P17
NODE=M070P17
OCCUR=2

$$\Gamma(\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}} \quad \Gamma_{154}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1 × 10⁻⁶	90	ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda \bar{\Lambda} \gamma$

NODE=M070S77
NODE=M070S77

$$\Gamma(\bar{\Lambda}(1520) \Lambda + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{155}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.80 × 10⁻³	90	LU	19 BELL	$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M070P60
NODE=M070P60

$$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}} \quad \Gamma_{156}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.17 ± 0.04	OUR AVERAGE			
1.165 ± 0.004 ± 0.043	135k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow J/\psi \rightarrow$ hadrons
1.20 ± 0.12 ± 0.21	206	ABLIKIM	080 BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S64
NODE=M070S64

$$\Gamma(\Xi(1530)^- \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{157}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.318 ± 0.008	OUR AVERAGE			
0.317 ± 0.002 ± 0.008	70k	ABLIKIM	20 BES3	$e^+ e^- \rightarrow J/\psi$
0.59 ± 0.09 ± 0.12	75	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S9
NODE=M070S9

$$\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}} \quad \Gamma_{158}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.32 ± 0.12 ± 0.07	24 ± 9	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S10
NODE=M070S10

$$\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{159}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S47
NODE=M070S47

$$\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}} \quad \Gamma_{160}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S48
NODE=M070S48

$$\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}} \quad \Gamma_{161}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S49
NODE=M070S49

$$\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}} \quad \Gamma_{162}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S50
NODE=M070S50

$$\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}} \quad \Gamma_{163}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S51
NODE=M070S51

STABLE HADRONS

NODE=M070307

$\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$

Γ_{164}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
5.44 ± 0.07 ± 0.33	23K	ANASHIN	22	KEDR $J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$
3.5 ± 0.8 ± 0.1	14k	1 LEES	21	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$
4.73 ± 0.44	228k	2 ABLIKIM	19Q	BES3 $J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$
3.25 ± 0.49	46055	AUGUSTIN	89	DM2 $J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$
3.17 ± 0.42	147	FRANKLIN	83	MRK2 $e^+e^- \rightarrow$ hadrons
3.64 ± 0.52	1500	BURMESTER	77D	PLUT e^+e^-
4 ± 1	675	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R9
NODE=M070R9

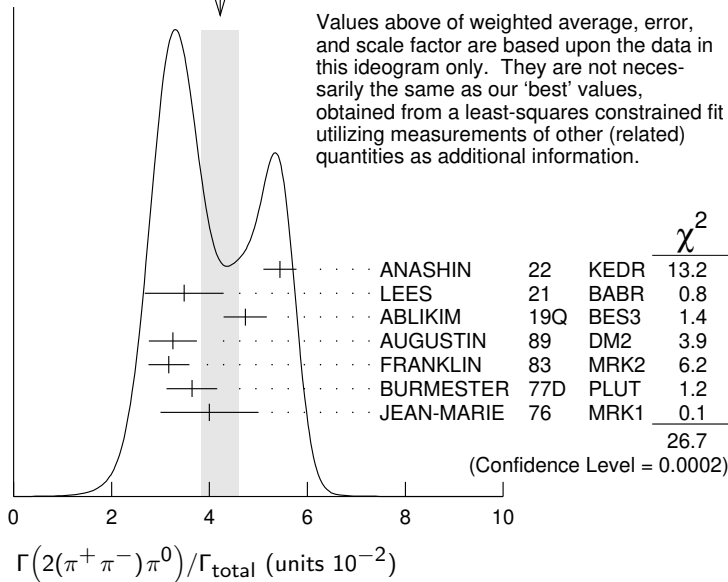
¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{total}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0)] = (14.8 \pm 2.6 \pm 2.2) \times 10^{-3}$ keV which we divide by our best values $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) = (18.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R9;LINKAGE=B

² From an energy scan of $e^+e^- \rightarrow J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$, assuming PDG 16 values for $\Gamma(e^+e^-)$, $\Gamma(\mu^+\mu^-)$, and $\Gamma(total)$, and for a phase difference between strong and electromagnetic amplitudes of $(84.9 \pm 3.6)^\circ$. An alternative solution is $(4.85 \pm 0.45)\%$ with a phase of $(-84.7 \pm 3.1)^\circ$.

NODE=M070R9;LINKAGE=A

WEIGHTED AVERAGE
4.2±0.4 (Error scaled by 2.1)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{total}$

Γ_{165}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.029 ± 0.006 OUR AVERAGE				
0.028 ± 0.009	11	FRANKLIN	83	MRK2 $e^+e^- \rightarrow$ hadrons
0.029 ± 0.007	181	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R11
NODE=M070R11

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$

Γ_{170}/Γ

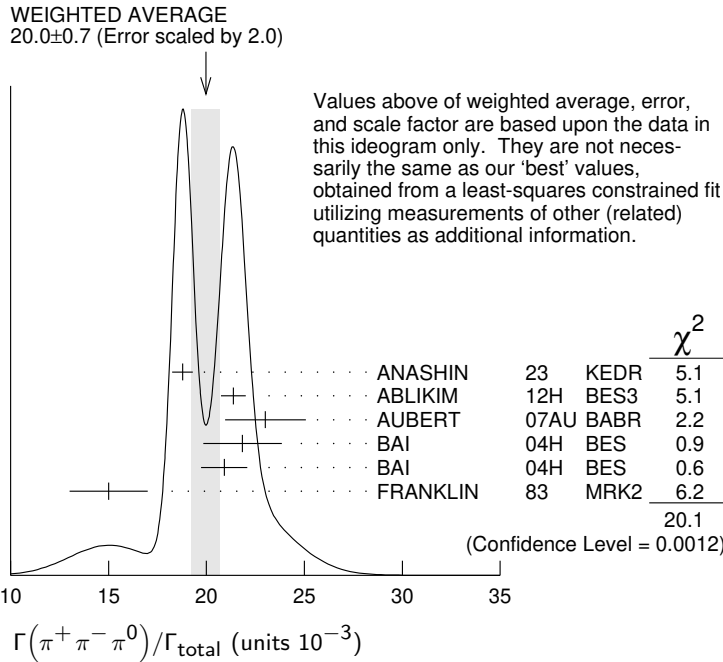
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
20.0 ± 0.7 OUR AVERAGE				Error includes scale factor of 2.0. See the ideogram below.
18.78 ± 0.13 ± 0.51	19.8k	1 ANASHIN	23	KEDR $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$
21.37 ± 0.04 ^{+0.64} _{-0.62}	1.8M	2 ABLIKIM	12H	BES3 $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$
23.0 ± 2.0 ± 0.4	256	3 AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
21.84 ± 0.05 ± 2.01	220k	4,5 BAI	04H	BES e^+e^-
20.91 ± 0.21 ± 1.16		5,6 BAI	04H	BES e^+e^-
15 ± 2	168	FRANKLIN	83	MRK2 e^+e^-

NODE=M070R7
NODE=M070R7

OCCUR=2

- ¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0\pi^0$, $J/\psi \rightarrow \rho^+\pi^-$, $J/\psi \rightarrow \rho^-\pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.
- ² The quoted systematic error includes a contribution of 1.23% (added in quadrature) from the uncertainty on the number of J/ψ events.
- ³ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] = (18.6 \pm 1.2 \pm 1.1) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.808 \pm 0.014$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁴ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.
- ⁵ Mostly $\rho\pi$, see also $\rho\pi$ subsection.
- ⁶ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R7;LINKAGE=B
 NODE=M070R7;LINKAGE=AB
 NODE=M070R7;LINKAGE=AU
 NODE=M070R;LINKAGE=BA
 NODE=M070R;LINKAGE=BU
 NODE=M070R;LINKAGE=BI



$\Gamma(\pi^+\pi^-\pi^0 K^+ K^-)/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.52±0.27 OUR AVERAGE		Error includes scale factor of 1.4.		
1.74±0.08±0.24	2616	ANASHIN	22	KEDR $J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1.2 ±0.3	309	VANNUCCI	77	MRK1 $e^+ e^-$

NODE=M070R18
 NODE=M070R18

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{173}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.47±0.14 OUR AVERAGE				
1.47±0.13±0.13	140	¹ METREVELI	12	$\psi(2S) \rightarrow 2(\pi^+\pi^-)$
1.58±0.20±0.15	84	BALTRUSAIT..85D	MRK3	$e^+ e^-$
1.0 ±0.5	5	BRANDELIK	78B	DASP $e^+ e^-$
1.6 ±1.6	1	VANNUCCI	77	MRK1 $e^+ e^-$

NODE=M070R6
 NODE=M070R6

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R6;LINKAGE=ME

$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{174}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.20±0.25 OUR AVERAGE		Error includes scale factor of 1.2.		
2.88±0.14±0.24	2654	ANASHIN	22	KEDR $J/\psi \rightarrow 2(\pi^+\pi^-)$
3.53±0.12±0.29	1107	¹ ABLIKIM	05H	BES2 $e^+ e^- \rightarrow \psi(2S) \rightarrow J/\psi \pi^+ \pi^-, J/\psi \rightarrow 2(\pi^+\pi^-)$
4.0 ±1.0	76	JEAN-MARIE	76	MRK1 $e^+ e^-$

NODE=M070R8
 NODE=M070R8

¹ Computed using $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

NODE=M070R8;LINKAGE=AB

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{175}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R10
 NODE=M070R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

40±20	32	JEAN-MARIE	76	MRK1	e^+e^-
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 $\Gamma(4(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{177}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R12
 NODE=M070R12

90±30	13	JEAN-MARIE	76	MRK1	e^+e^-
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 $\Gamma(2(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{178}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S42
 NODE=M070S42

2.29±0.28 OUR AVERAGE

3.1 ±1.5 ±0.1	14k	¹ LEES	21	BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$
2.26±0.08±0.27	4.8k	ABLIKIM	05C	BES2	$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta$

NODE=M070S42;LINKAGE=A

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] \times [B(\eta \rightarrow 3\pi^0)] = (5.6 \pm 2.6 \pm 0.8) \times 10^{-3}$ keV which we divide by our best values $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.53 \pm 0.10$ keV, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

 $\Gamma(3(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{179}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S43
 NODE=M070S43

7.24±0.96±1.11	616	ABLIKIM	05C	BES2	$e^+e^- \rightarrow 3(\pi^+\pi^-)\eta$
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 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{183}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R13
 NODE=M070R13

3.06 ±0.05 OUR AVERAGE

[(2.86 ± 0.21) × 10⁻⁴ OUR 2024 AVERAGE]

3.072±0.023±0.050	1.8 k	¹ ABLIKIM	24AB	BES3	$\psi(2S) \rightarrow \pi^+\pi^-K^+K^-$
2.86 ±0.09 ±0.19	1k	² METREVELI	12		$\psi(2S) \rightarrow \pi^+\pi^-K^+K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.39 ±0.24 ±0.22	107	³ BALTRUSAIT..85D	MRK3		e^+e^-
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2.2 ±0.9	6	³ BRANDELIK	79C	DASP	e^+e^-
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¹ Using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.916 \pm 0.033)\%$.

² Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

³ Interference with non-resonant K^+K^- production not taken into account.

NODE=M070R13;LINKAGE=D
 NODE=M070R13;LINKAGE=ME
 NODE=M070R13;LINKAGE=BA

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{184}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R75
 NODE=M070R75

1.95±0.11 OUR AVERAGE Error includes scale factor of 2.4. See the ideogram below.

1.93±0.01±0.05	110k	ABLIKIM	17AH	BES3	$J/\psi \rightarrow K_S^0 K_L^0 \rightarrow \pi^+\pi^-X$
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2.62±0.15±0.14	0.3k	¹ METREVELI	12		$\psi(2S) \rightarrow \pi^+\pi^-K_S^0 K_L^0$
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1.82±0.04±0.13	2.1k	² BAI	04A	BES2	$J/\psi \rightarrow K_S^0 K_L^0 \rightarrow \pi^+\pi^-X$
----------------	------	------------------	-----	------	--

• • • We do not use the following data for averages, fits, limits, etc. • • •

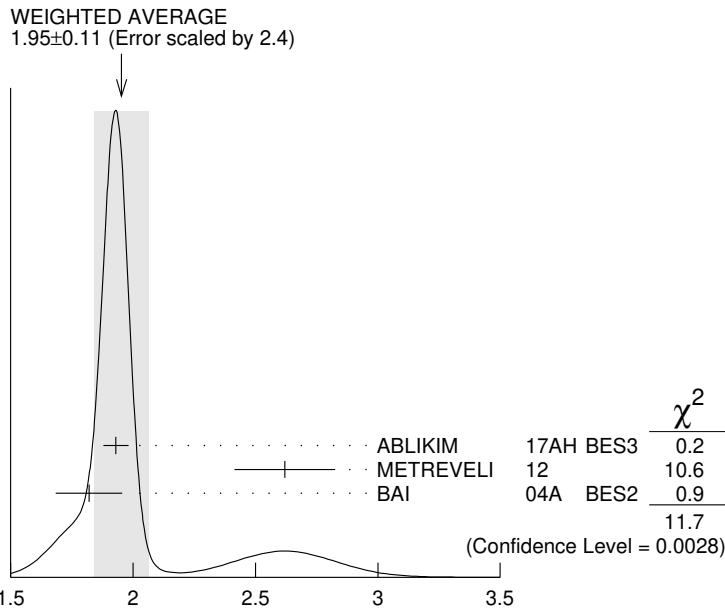
1.18±0.12±0.18		JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
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1.01±0.16±0.09	74	BALTRUSAIT..85D	MRK3		e^+e^-
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¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6868 \pm 0.0027$.

NODE=M070R75;LINKAGE=ME
 NODE=M070R;LINKAGE=HZ



$\Gamma(K_S^0 K_L^0)/\Gamma_{total}$ Γ_{184}/Γ

$\Gamma(K_S^0 K_S^0)/\Gamma_{total}$ Γ_{185}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-8}$	95	¹ ABLIKIM	17AH BES3	$J/\psi \rightarrow K_S^0 K_S^0 \rightarrow \pi^+ \pi^- \pi^+ \pi^-$

NODE=M070R14
NODE=M070R14

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1 \times 10^{-6}$	95	¹ BAI	04D BES	$e^+ e^-$
$<5.2 \times 10^{-6}$	90	¹ BALTRUSAIT..85C	MRK3	$e^+ e^-$

¹ Forbidden by CP.

NODE=M070R14;LINKAGE=C

$\Gamma(K \bar{K} \pi)/\Gamma_{total}$ Γ_{186}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ± 10 OUR AVERAGE				
55.2 ± 12.0	25	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow K^+ K^- \pi^0$
78.0 ± 21.0	126	VANNUCCI	77 MRK1	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M070R15
NODE=M070R15

$\Gamma(K^+ K^- \pi^0)/\Gamma_{total}$ Γ_{187}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.88 ± 0.01 ± 0.12	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P80
NODE=M070P80

$\Gamma(K^+ K^- \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ $\Gamma_{187}/\Gamma_{170}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
12.0 ± 0.3 ± 0.9	23k	LEES	17C BABR	$J/\psi \rightarrow h^+ h^- \pi^0$

NODE=M070P34
NODE=M070P34

$\Gamma(K_S^0 K^\pm \pi^\mp)/\Gamma(\pi^+ \pi^- \pi^0)$ $\Gamma_{188}/\Gamma_{170}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
26.5 ± 0.5 ± 2.1	24k	LEES	17C BABR	$J/\psi \rightarrow h^0 h^+ h^-$

NODE=M070P35
NODE=M070P35

$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{total}$ Γ_{192}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.04 ± 0.26 ± 0.92	2671	ANASHIN	22 KEDR	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M070R16
NODE=M070R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.2 ± 2.3	205	VANNUCCI	77 MRK1	$e^+ e^-$
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$\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{total}$ Γ_{204}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
31 ± 13	30	VANNUCCI	77 MRK1	$e^+ e^-$

NODE=M070R17
NODE=M070R17

$\Gamma(2(K^+ K^-))/\Gamma_{total}$

Γ_{206}/Γ

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

NODE=M070R19
NODE=M070R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.4^{+0.5}_{-0.4} \pm 0.2$ $11.0^{+4.3}_{-3.5}$ ¹ HUANG 03 BELL $B^+ \rightarrow 2(K^+ K^-) K^+$
0.7 ± 0.3 VANNUCCI 77 MRK1 $e^+ e^-$

¹ Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

NODE=M070R19;LINKAGE=CC

$\Gamma(p\bar{p})/\Gamma_{total}$

Γ_{214}/Γ

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

NODE=M070R50
NODE=M070R50

2.120 \pm 0.029 OUR AVERAGE

2.112 \pm 0.004 \pm 0.031 314k ABLIKIM 12C BES3 $e^+ e^-$
2.17 \pm 0.16 \pm 0.04 317 ¹ WU 06 BELL $B^+ \rightarrow p\bar{p} K^+$
2.26 \pm 0.01 \pm 0.14 63316 BAI 04E BES2 $e^+ e^- \rightarrow J/\psi$
1.97 \pm 0.22 99 BALDINI 98 FENI $e^+ e^-$
1.91 \pm 0.04 \pm 0.30 PALLIN 87 DM2 $e^+ e^-$
2.16 \pm 0.07 \pm 0.15 1420 EATON 84 MRK2 $e^+ e^-$
2.5 \pm 0.4 133 BRANDELIK 79C DASP $e^+ e^-$
2.0 \pm 0.5 BESCH 78 BONA $e^+ e^-$
2.2 \pm 0.2 331 ² PERUZZI 78 MRK1 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.0 \pm 0.3 48 ANTONELLI 93 SPEC $e^+ e^-$
¹ WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow p\bar{p})/\Gamma_{total}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] = (2.21 \pm 0.13 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = (1.020 \pm 0.019) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R50;LINKAGE=WU

² Assuming angular distribution $(1 + \cos^2\theta)$.

NODE=M070R50;LINKAGE=A

$\Gamma(p\bar{p}\pi^0)/\Gamma_{total}$

Γ_{215}/Γ

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

NODE=M070R52
NODE=M070R52

1.19 \pm 0.08 OUR AVERAGE Error includes scale factor of 1.1.

1.33 \pm 0.02 \pm 0.11 11k ABLIKIM 09B BES2 $e^+ e^-$
1.13 \pm 0.09 \pm 0.09 685 EATON 84 MRK2 $e^+ e^-$
1.4 \pm 0.4 BRANDELIK 79C DASP $e^+ e^-$
1.00 \pm 0.15 109 PERUZZI 78 MRK1 $e^+ e^-$

$\Gamma(p\bar{p}\pi^+ \pi^-)/\Gamma_{total}$

Γ_{216}/Γ

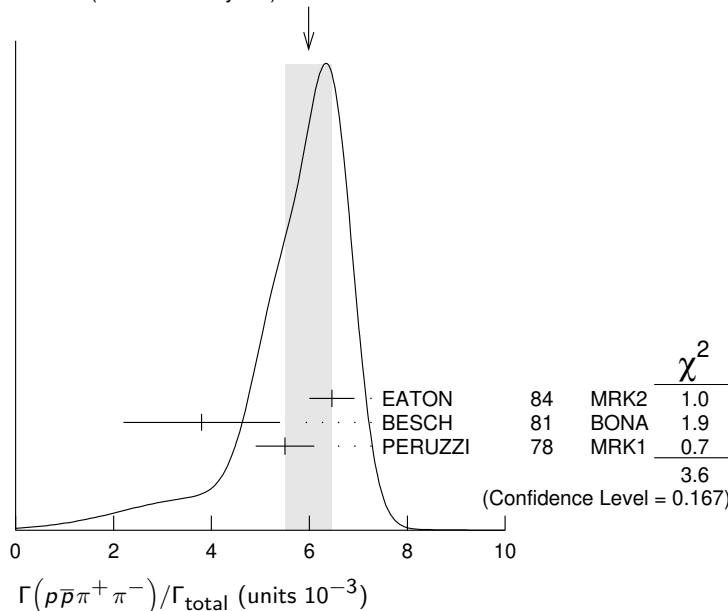
VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

NODE=M070R54
NODE=M070R54

6.0 \pm 0.5 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

6.46 \pm 0.17 \pm 0.43 1435 EATON 84 MRK2 $e^+ e^-$
3.8 \pm 1.6 48 BESCH 81 BONA $e^+ e^-$
5.5 \pm 0.6 533 PERUZZI 78 MRK1 $e^+ e^-$

WEIGHTED AVERAGE
6.0 \pm 0.5 (Error scaled by 1.3)



$\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{total}$

Γ_{217}/Γ

Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

NODE=M070R55
NODE=M070R55
NODE=M070R55

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.9 OUR AVERAGE				Error includes scale factor of 1.9.
3.36 ± 0.65 ± 0.28	364	EATON	84 MRK2	e^+e^-
1.6 ± 0.6	39	PERUZZI	78 MRK1	e^+e^-

$\Gamma(p\bar{p}\eta)/\Gamma_{total}$

Γ_{218}/Γ

NODE=M070R56
NODE=M070R56

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 ± 0.12 OUR AVERAGE				
1.91 ± 0.02 ± 0.17	13k	¹ ABLIKIM	09 BES2	e^+e^-
2.03 ± 0.13 ± 0.15	826	EATON	84 MRK2	e^+e^-
2.5 ± 1.2		BRANDELIK	79C DASP	e^+e^-
2.3 ± 0.4	197	PERUZZI	78 MRK1	e^+e^-

¹ From the combination of $p\bar{p}\eta \rightarrow p\bar{p}\gamma\gamma$ and $p\bar{p}\eta \rightarrow p\bar{p}\pi^+\pi^-\pi^0$ channels.

NODE=M070R56;LINKAGE=AB

$\Gamma(p\bar{p}\rho)/\Gamma_{total}$

Γ_{219}/Γ

NODE=M070R57
NODE=M070R57

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.31 × 10⁻³	90	EATON	84 MRK2	$e^+e^- \rightarrow \text{hadrons}\gamma$

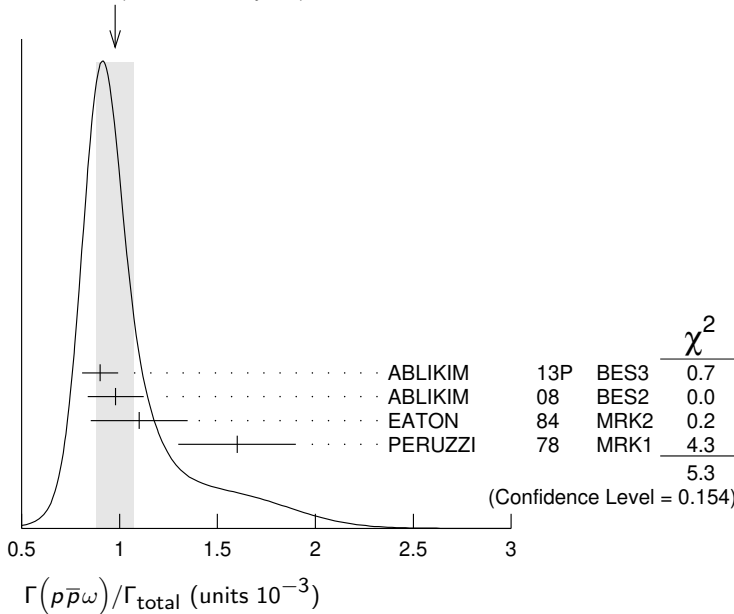
$\Gamma(p\bar{p}\omega)/\Gamma_{total}$

Γ_{220}/Γ

NODE=M070R58
NODE=M070R58

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 ± 0.10 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.90 ± 0.02 ± 0.09	2670	ABLIKIM	13P BES3	e^+e^-
0.98 ± 0.03 ± 0.14	2449	ABLIKIM	08 BES2	e^+e^-
1.10 ± 0.17 ± 0.18	486	EATON	84 MRK2	e^+e^-
1.6 ± 0.3	77	PERUZZI	78 MRK1	e^+e^-

WEIGHTED AVERAGE
0.98 ± 0.10 (Error scaled by 1.3)



$\Gamma(p\bar{p}\eta'(958))/\Gamma_{total}$

Γ_{221}/Γ

NODE=M070R59
NODE=M070R59

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.129 ± 0.014 OUR AVERAGE				Error includes scale factor of 2.0.
0.126 ± 0.002 ± 0.007	16k	¹ ABLIKIM	19N BES3	e^+e^-
0.200 ± 0.023 ± 0.028	265 ± 31	² ABLIKIM	09 BES2	e^+e^-
0.68 ± 0.23 ± 0.17	19	EATON	84 MRK2	e^+e^-
1.8 ± 0.6	19	PERUZZI	78 MRK1	e^+e^-

¹ From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\gamma$ channels.

NODE=M070R59;LINKAGE=A
NODE=M070R59;LINKAGE=AB

² From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\gamma\rho^0$ channels.

$\Gamma(p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta)/\Gamma_{total}$

Γ_{222}/Γ

NODE=M070S94
NODE=M070S94

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.8 ± 1.2 ± 1.3	ABLIKIM	14N BES3	$e^+e^- \rightarrow J/\psi$

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**0.519±0.033 OUR AVERAGE**

0.523±0.006±0.033 14k

0.45 ±0.13 ±0.07

DOCUMENT ID TECN COMMENT

ABLIKIM 16K BES3 $J/\psi \rightarrow p\bar{p}K_S^0 K_L^0,$ FALVARD 88 DM2 $J/\psi \rightarrow p\bar{p}K^+ K^-$
 $J/\psi \rightarrow \text{hadrons}$ Γ_{223}/Γ NODE=M070S22
NODE=M070S22 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**2.12±0.09 OUR AVERAGE**

2.36±0.02±0.21 59k

2.47±0.02±0.24 55k

2.02±0.07±0.16 1288

1.93±0.07±0.16 1191

1.7 ±0.7 32

1.6 ±1.2 5

2.16±0.29 194

2.04±0.27 204

DOCUMENT ID TECN COMMENT

ABLIKIM 06K BES2 $J/\psi \rightarrow p\pi^-\bar{n}$ ABLIKIM 06K BES2 $J/\psi \rightarrow \bar{p}\pi^+ n$ EATON 84 MRK2 $e^+e^- \rightarrow p\pi^-$ EATON 84 MRK2 $e^+e^- \rightarrow \bar{p}\pi^+$ BESCH 81 BONA $e^+e^- \rightarrow p\pi^-$ BESCH 81 BONA $e^+e^- \rightarrow \bar{p}\pi^+$ PERUZZI 78 MRK1 $e^+e^- \rightarrow p\pi^-$ PERUZZI 78 MRK1 $e^+e^- \rightarrow \bar{p}\pi^+$ Γ_{224}/Γ NODE=M070R53
NODE=M070R53 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**2.09±0.16 OUR AVERAGE**

2.07±0.01±0.17 36k

2.31±0.49 79

1.8 ±0.9

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.90±0.55 40

DOCUMENT ID TECN COMMENT

ABLIKIM 12C BES3 e^+e^- BALDINI 98 FENI e^+e^- BESCH 78 BONA e^+e^- ANTONELLI 93 SPEC e^+e^- Γ_{225}/Γ NODE=M070R64
NODE=M070R64 $\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**3.8±3.6** 5

DOCUMENT ID TECN COMMENT

BESCH 81 BONA e^+e^- Γ_{226}/Γ NODE=M070R65
NODE=M070R65 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.88 ±0.08 OUR AVERAGE**

1.64 ±0.12 ±0.09

1.943±0.003±0.033 441k

2.03 ±0.03 ±0.15 8887

1.96 $^{+0.47}_{-0.44}$ ±0.04 46

1.08 ±0.06 ±0.24 631

1.38 ±0.05 ±0.20 1847

1.58 ±0.08 ±0.19 365

2.6 ±1.6 5

1.1 ±0.2 196

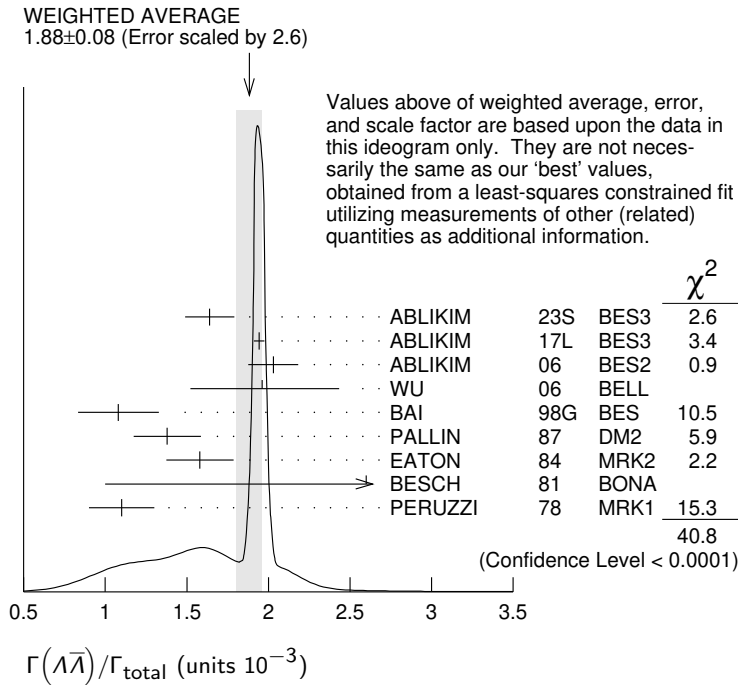
DOCUMENT ID TECN COMMENT

Error includes scale factor of 2.6. See the ideogram below.

ABLIKIM 23S BES3 $e^+e^- \rightarrow \gamma\Lambda\bar{\Lambda}$ ABLIKIM 17L BES3 e^+e^- ABLIKIM 06 BES2 $J/\psi \rightarrow \Lambda\bar{\Lambda}$ ¹WU 06 BELL $B^+ \rightarrow \Lambda\bar{\Lambda}K^+$ BAI 98G BES e^+e^- PALLIN 87 DM2 e^+e^- EATON 84 MRK2 e^+e^- BESCH 81 BONA e^+e^- PERUZZI 78 MRK1 e^+e^- Γ_{230}/Γ NODE=M070R60
NODE=M070R60

¹WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.00^{+0.34}_{-0.29} \pm 0.34) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60;LINKAGE=WU



$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{total}$

Γ_{231}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.78±0.27±0.30		323	1 ABLIKIM	13F BES3	$J/\psi \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$

NODE=M070S11
NODE=M070S11

••• We do not use the following data for averages, fits, limits, etc. •••

< 6.4	90	2 ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$
23 ±7 ±8	11	BAI	98G BES	e^+e^-
22 ±5 ±5	19	HENRARD	87 DM2	e^+e^-

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.

² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

NODE=M070S11;LINKAGE=AL
NODE=M070S11;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{total}$

Γ_{232}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.30±0.13±0.99	2.4k	ABLIKIM	12P BES2	J/ψ

NODE=M070S78
NODE=M070S78

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{total}$

Γ_{233}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
16.2±1.7 OUR AVERAGE				
15.7±0.80±1.54	454	1 ABLIKIM	13F BES3	$J/\psi \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
26.2±6.0 ±4.4	44	2 ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M070R07
NODE=M070R07

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.

² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M070R07;LINKAGE=AL
NODE=M070R07;LINKAGE=AB

$\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + c.c.)/\Gamma_{total}$

Γ_{234}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.26 ±0.05 OUR AVERAGE				Error includes scale factor of 1.2.
1.244±0.002±0.045	2.6M	ABLIKIM	23BU BES3	e^+e^-
1.52 ±0.08 ±0.16	589	1 ABLIKIM	07H BES2	e^+e^-
1.11 ±0.06 ±0.20	342 ± 18	HENRARD	87 DM2	e^+e^-
1.38 ±0.21 ±0.35	118	EATON	84 MRK2	e^+e^-

NODE=M070R71
NODE=M070R71

OCCUR=3
OCCUR=2
OCCUR=2

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.

NODE=M070R71;LINKAGE=AB

$\Gamma(\Lambda\bar{\Sigma}^+\pi^- + c.c.)/\Gamma_{total}$

Γ_{235}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.21 ±0.07 OUR AVERAGE				Error includes scale factor of 1.8.
1.221±0.002±0.038	2.7M	ABLIKIM	23BU BES3	e^+e^-
0.90 ±0.06 ±0.16	225	HENRARD	87 DM2	e^+e^-
1.53 ±0.17 ±0.38	135	EATON	84 MRK2	e^+e^-

NODE=M070Q46
NODE=M070Q46

$\Gamma(pK^-\bar{\Lambda}+c.c.)/\Gamma_{\text{total}}$ Γ_{236}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070R72
NODE=M070R72

0.86±0.11 OUR AVERAGE

$0.84^{+0.17}_{-0.15} \pm 0.02$	45	¹ LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$
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$0.89 \pm 0.07 \pm 0.14$	307	EATON	84	MRK2 e^+e^-
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¹ LU 19 reports $(8.32^{+1.63}_{-1.45} \pm 0.49) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow pK^-\bar{\Lambda}+c.c.)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)]$ assuming $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.026 \pm 0.031) \times 10^{-3}$, which we rescale to our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R72;LINKAGE=A

 $\Gamma(pK^-\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{237}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070R73
NODE=M070R73

0.29±0.06±0.05

	90	EATON	84	MRK2 e^+e^-
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 $\Gamma(pK_S^0\bar{\Sigma}^-+c.c.)/\Gamma_{\text{total}}$ Γ_{238}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q73
NODE=M070Q73

2.725±0.009±0.050

	120k	¹ ABLIKIM	24H	BES3 $e^+e^- \rightarrow J/\psi$
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¹ The branching fractions for the charge-conjugate channels are measured separately as $(1.361 \pm 0.006 \pm 0.025) \times 10^{-4}$ for $\bar{p}K_S^0\Sigma^+$ and $(1.352 \pm 0.006 \pm 0.025) \times 10^{-4}$ for $pK_S^0\bar{\Sigma}^-$.

NODE=M070Q73;LINKAGE=A

 $\Gamma(\bar{\Lambda}nK_S^0+c.c.)/\Gamma_{\text{total}}$ Γ_{239}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070S56
NODE=M070S56

6.46±0.20±1.07

	1058	¹ ABLIKIM	08C	BES2 $e^+e^- \rightarrow J/\psi$
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¹ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.

NODE=M070S56;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Sigma}+c.c.)/\Gamma_{\text{total}}$ Γ_{240}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070R61
NODE=M070R61

2.83±0.23 OUR AVERAGE

$2.74 \pm 0.24 \pm 0.22$	234 ± 21	¹ ABLIKIM	12B	BES3	$J/\psi \rightarrow \Lambda\bar{\Sigma}^0$
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$2.92 \pm 0.22 \pm 0.24$	308 ± 24	² ABLIKIM	12B	BES3	$J/\psi \rightarrow \bar{\Lambda}\Sigma^0$
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OCCUR=2

••• We do not use the following data for averages, fits, limits, etc. •••

<18		² HENRARD	87	DM2	$J/\psi \rightarrow \bar{\Lambda}\Sigma^0$
<15	90	PERUZZI	78	MRK1	$e^+e^- \rightarrow \Lambda X$

¹ ABLIKIM 12B quotes $B(J/\psi \rightarrow \Lambda\bar{\Sigma}^0)$ which we multiply by 2.

² ABLIKIM 12B and HENRARD 87 quote results for $B(J/\psi \rightarrow \bar{\Lambda}\Sigma^0)$ which we multiply by 2.

NODE=M070R61;LINKAGE=AB
NODE=M070R61;LINKAGE=AC

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{241}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070S09
NODE=M070S09

1.07 ±0.04 OUR AVERAGE

$1.061 \pm 0.004 \pm 0.036$	87k	ABLIKIM	21AT	BES3 $J/\psi \rightarrow p\pi^0\bar{p}\pi^0$
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$1.50 \pm 0.10 \pm 0.22$	399	ABLIKIM	08O	BES2 $e^+e^- \rightarrow J/\psi$
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 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{242}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070R63
NODE=M070R63

1.172±0.032 OUR AVERAGE Error includes scale factor of 1.4.

$1.164 \pm 0.004 \pm 0.023$	111k	ABLIKIM	17L	BES3	$J/\psi \rightarrow \Sigma^0\bar{\Sigma}^0$
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$1.33 \pm 0.04 \pm 0.11$	1.7k	ABLIKIM	06	BES2	$J/\psi \rightarrow \Sigma^0\bar{\Sigma}^0$
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$1.06 \pm 0.04 \pm 0.23$	884	PALLIN	87	DM2	$e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0$
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$1.58 \pm 0.16 \pm 0.25$	90	EATON	84	MRK2	$e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0$
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1.3 ± 0.4	52	PERUZZI	78	MRK1	$e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0$
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••• We do not use the following data for averages, fits, limits, etc. •••

2.4 ± 2.6	3	BESCH	81	BONA	$e^+e^- \rightarrow \Sigma^+\bar{\Sigma}^-$
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 $\Gamma(\Sigma^+\bar{\Sigma}^-\eta)/\Gamma_{\text{total}}$ Γ_{243}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q45
NODE=M070Q45

6.34±0.21±0.37

	1821	ABLIKIM	22AY	BES3 $J/\psi \rightarrow \Sigma^+\bar{\Sigma}^-\eta$
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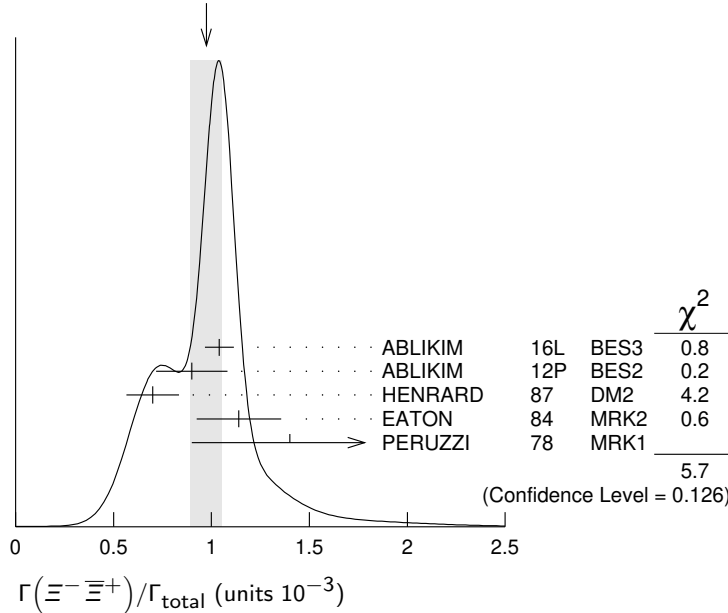
$\Gamma(\Xi^- \Xi^+)/\Gamma_{total}$

Γ_{244}/Γ

NODE=M070R62
NODE=M070R62

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.08 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1.040 ± 0.006 ± 0.074	43k	ABLIKIM	16L BES3	$J/\psi \rightarrow \Xi^- \Xi^+$
0.90 ± 0.03 ± 0.18	961	ABLIKIM	12P BES2	$J/\psi \rightarrow \Xi^- \Xi^+$
0.70 ± 0.06 ± 0.12	132	HENRARD	87 DM2	$e^+ e^- \rightarrow \Xi^- \Xi^+$
1.14 ± 0.08 ± 0.20	194	EATON	84 MRK2	$e^+ e^- \rightarrow \Xi^- \Xi^+$
1.4 ± 0.5	51	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Xi^- \Xi^+$

WEIGHTED AVERAGE
0.97 ± 0.08 (Error scaled by 1.4)



RADIATIVE DECAYS

NODE=M070310

$\Gamma(\gamma \eta_c(1S))/\Gamma_{total}$

Γ_{245}/Γ

NODE=M070R85
NODE=M070R85

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.41 ± 0.14 OUR FIT	Error includes scale factor of 1.3.		
1.7 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.5.		
2.00 ± 0.31 ± 0.02	¹ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
1.27 ± 0.36	GAISER	86 CBAL	$J/\psi \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
3.40 ± 0.33	² ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma \eta_c$

¹ MITCHELL 09 reports $(1.98 \pm 0.09 \pm 0.30) \times 10^{-2}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{total}] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (35.04 \pm 0.07 \pm 0.77) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Statistical uncertainty only.

NODE=M070R85;LINKAGE=M1

NODE=M070R85;LINKAGE=A

$\Gamma(3\gamma)/\Gamma_{total}$

Γ_{248}/Γ

NODE=M070R81
NODE=M070R81

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
11.6 ± 2.2 OUR AVERAGE					
11.3 ± 1.8 ± 2.0	113 ± 18		ABLIKIM	13i BES3	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
12 ± 3 ± 2	24.2 ^{+7.2} _{-6.0}		ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<55	90		PARTRIDGE	80 CBAL	$e^+ e^-$

$\Gamma(4\gamma)/\Gamma_{total}$

Γ_{249}/Γ

NODE=M070S06
NODE=M070S06

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9 × 10⁻⁶	90	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

$\Gamma(5\gamma)/\Gamma_{total}$

Γ_{250}/Γ

NODE=M070S07
NODE=M070S07

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15 × 10⁻⁶	90	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

$\Gamma(\gamma\pi^0)/\Gamma_{total}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.39 ± 0.08 OUR AVERAGE				
3.34 ± 0.02 ± 0.09	176k	ABLIKIM	23BD BES3	$J/\psi \rightarrow \pi^0 \gamma$
3.59 ± 0.20 ± 0.03	1.6k	¹ ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma$
3.63 ± 0.36 ± 0.13		PEDLAR	09 CLE3	$J/\psi \rightarrow \pi^0 \gamma$
3.13 ^{+0.65} _{-0.47}	586	ABLIKIM	06E BES2	$J/\psi \rightarrow \pi^0 \gamma$

Γ_{251}/Γ

NODE=M070R82
NODE=M070R82

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.6 ± 1.1 ± 0.7		BLOOM	83 CBAL	$e^+ e^-$
7.3 ± 4.7	10	BRANDELIK	79C DASP	$e^+ e^-$

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\pi^0)/\Gamma_{total}] \times [B(\pi^0 \rightarrow 2\gamma)] = (3.57 \pm 0.12 \pm 0.16) \times 10^{-5}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma\pi^0)/\Gamma_{total}] \times [B(\pi^0 \rightarrow 2\gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$, which we rescale to our best values $B(\pi^0 \rightarrow 2\gamma) = (98.823 \pm 0.034) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R82;LINKAGE=A

$\Gamma(\gamma\pi^0\pi^0)/\Gamma_{total}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.15 ± 0.05			
	¹ ABLIKIM	15AE BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

Γ_{252}/Γ

NODE=M070B00
NODE=M070B00

¹ The uncertainty is systematic as statistical is negligible.

NODE=M070B00;LINKAGE=A

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{total}$

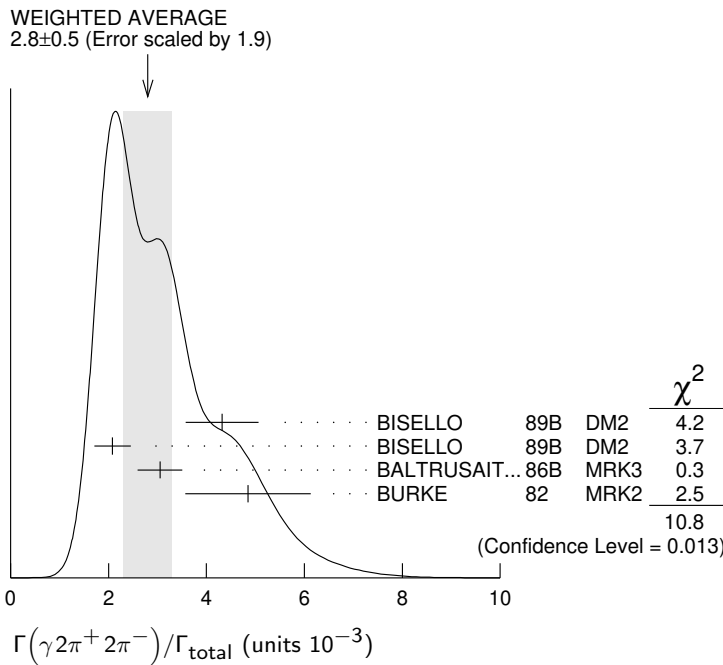
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.5 OUR AVERAGE			
4.32 ± 0.14 ± 0.73	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
2.08 ± 0.13 ± 0.35	² BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
3.05 ± 0.08 ± 0.45	² BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
4.85 ± 0.45 ± 1.20	³ BURKE	82 MRK2	$e^+ e^-$

Γ_{253}/Γ

NODE=M070R95
NODE=M070R95

- ¹ 4π mass less than 3.0 GeV.
- ² 4π mass less than 2.0 GeV.
- ³ 4π mass less than 2.5 GeV.

NODE=M070R95;LINKAGE=A
NODE=M070R95;LINKAGE=B
NODE=M070R95;LINKAGE=M



$\Gamma(\gamma f_2(1270) f_2(1270))/\Gamma_{total}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.5 ± 0.7 ± 1.6				
	646 ± 45	ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

Γ_{254}/Γ

NODE=M070S45
NODE=M070S45

$\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{255}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.2±0.8±1.7	¹ ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S46
 NODE=M070S46

¹ Subtracting contribution from intermediate $\eta_c(1S)$ decays.

NODE=M070S46;LINKAGE=AB

 $\Gamma(\gamma \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{256}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.3±0.2±3.1	¹ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070R99
 NODE=M070R99

¹ 4π mass less than 2.0 GeV.

NODE=M070R99;LINKAGE=M

 $\Gamma(\gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{257}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.1±0.4	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P73
 NODE=M070P73

 $\Gamma(\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}])/ \Gamma_{\text{total}}$ Γ_{258}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.7 ±0.4 OUR AVERAGE	Error includes scale factor of 2.1.		
0.58±0.03±0.20	¹ BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
2.1 ±0.1 ±0.7	² BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

NODE=M070S38
 NODE=M070S38

¹ For a broad structure around 1800 MeV.

² For a broad structure around 2040 MeV.

OCCUR=2

NODE=M070S38;LINKAGE=BD
 NODE=M070S38;LINKAGE=BE

 $\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{259}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.1±0.6	1516	BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B05
 NODE=M070B05

 $\Gamma(\gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{260}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0±0.3±1.3	320	¹ BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B07
 NODE=M070B07

¹ Summed over all charges.

NODE=M070R;LINKAGE=B7

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{261}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.090±0.013 OUR AVERAGE				
1.096±0.001±0.019	2.2M	ABLIKIM	23BD BES3	$J/\psi \rightarrow \eta\gamma$
1.067±0.005±0.023	87.9k	ABLIKIM	21AMBES3	$e^+ e^- \rightarrow J/\psi$
1.12 ±0.05 ±0.01	18.6k	¹ ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma\gamma\gamma$
1.101±0.029±0.022		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta\gamma$
1.123±0.089	11k	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta\gamma$

NODE=M070R83
 NODE=M070R83

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.88 ±0.08 ±0.11	BLOOM	83	CBAL	$e^+ e^-$
0.82 ±0.10	BRANDELIK	79C	DASP	$e^+ e^-$
1.3 ±0.4	BARTEL	77	CNTR	$e^+ e^-$

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\eta)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = (4.42 \pm 0.04 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma\eta)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.49 \pm 0.30) \times 10^{-2}$, which we rescale to our best values $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R83;LINKAGE=A

 $\Gamma(\gamma\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{262}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
21.4±1.8±2.5	596	ABLIKIM	16P BES3	$J/\psi \rightarrow 5\gamma$

NODE=M070P01
 NODE=M070P01

 $\Gamma(\gamma f_0(500) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{263}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
10.5±2.0	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P95
 NODE=M070P95

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $\Gamma(\gamma f_0(500) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{264}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
5±5	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P97
 NODE=M070P97

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Gamma(\gamma f_0(500) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{265} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070P98
 NODE=M070P98

• • • We do not use the following data for averages, fits, limits, etc. • • •

4±3	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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 $\Gamma(\gamma a_0(980)^0 \rightarrow \gamma \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{266} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070P02
 NODE=M070P02

$<2.5 \times 10^{-6}$	95	ABLIKIM 16P	BES3	$J/\psi \rightarrow 5\gamma$
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 $\Gamma(\gamma a_2(1320)^0 \rightarrow \gamma \eta \pi^0) / \Gamma_{\text{total}}$ Γ_{267} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070P03
 NODE=M070P03

$<6.6 \times 10^{-6}$	95	ABLIKIM 16P	BES3	$J/\psi \rightarrow 5\gamma$
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 $\Gamma(\gamma \eta \pi \pi) / \Gamma_{\text{total}}$ Γ_{268} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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NODE=M070R96
 NODE=M070R96

6.1 ± 1.0 OUR AVERAGE

5.85 ± 0.3 ± 1.05	¹ EDWARDS	83B	CBAL	$J/\psi \rightarrow \eta \pi^+ \pi^-$
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7.8 ± 1.2 ± 2.4	¹ EDWARDS	83B	CBAL	$J/\psi \rightarrow \eta 2\pi^0$
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OCCUR=2

¹ Broad enhancement at 1700 MeV.

NODE=M070R96;LINKAGE=M

 $\Gamma(\gamma \eta_2(1870) \rightarrow \gamma \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{269} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
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NODE=M070S37
 NODE=M070S37

6.2 ± 2.2 ± 0.9	BAI	99	BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
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 $\Gamma(\gamma \eta'(958)) / \Gamma_{\text{total}}$ Γ_{270} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R84
 NODE=M070R84

5.28 ± 0.06 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

5.40 ± 0.01 ± 0.11	638k	ABLIKIM	23BD	BES3	$J/\psi \rightarrow \gamma \eta'$
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5.27 ± 0.03 ± 0.05	36k	ABLIKIM	19T	BES	$J/\psi \rightarrow \gamma \eta'$
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5.43 ± 0.23 ± 0.09	5.0k	¹ ABLIKIM	180	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$
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4.76 ± 0.22 ± 0.06		² ABLIKIM	11	BES3	$J/\psi \rightarrow \eta' \gamma$
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5.24 ± 0.12 ± 0.11		PEDLAR	09	CLE3	$J/\psi \rightarrow \eta' \gamma$
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5.55 ± 0.44	35k	ABLIKIM	06E	BES2	$J/\psi \rightarrow \eta' \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.50 ± 0.14 ± 0.53		BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta, \eta \rightarrow \gamma \gamma$
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OCCUR=2

4.30 ± 0.31 ± 0.71		BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta, \eta \rightarrow \pi^+ \pi^- \pi^0$
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OCCUR=2

4.04 ± 0.16 ± 0.85	622	AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
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4.39 ± 0.09 ± 0.66	2420	AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
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4.1 ± 0.3 ± 0.6		BLOOM	83	CBAL	$e^+ e^- \rightarrow 3\gamma + \text{hadrons}$
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2.9 ± 1.1	6	BRANDELIK	79C	DASP	$e^+ e^- \rightarrow 3\gamma$
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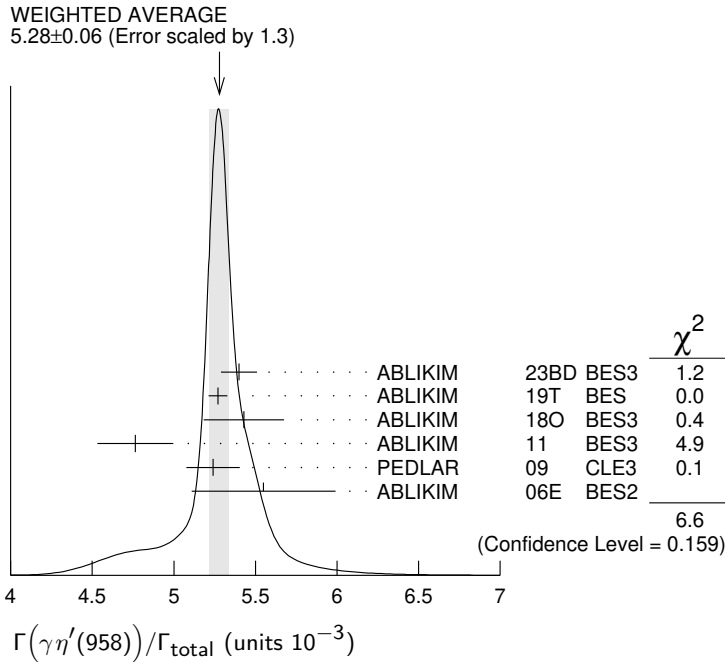
2.4 ± 0.7	57	BARTEL	76	CNTR	$e^+ e^- \rightarrow 2\gamma \rho$
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NODE=M070R84;LINKAGE=A

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958)) / \Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \gamma \gamma)] = (1.26 \pm 0.02 \pm 0.05) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958)) / \Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \gamma \gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.49 \pm 0.30) \times 10^{-2}$, which we rescale to our best values $B(\eta'(958) \rightarrow \gamma \gamma) = (2.307 \pm 0.033) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

² ABLIKIM 11 reports $(4.84 \pm 0.03 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958)) / \Gamma_{\text{total}}] / [B(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)]$ assuming $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (43.2 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$, which we rescale to our best values $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (42.5 \pm 0.5) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84;LINKAGE=AB



$\Gamma(\gamma f_0(980) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ **Γ_{271} / Γ**
 VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT NODE=M070P90
 NODE=M070P90

• • • We do not use the following data for averages, fits, limits, etc. • • •
 1.3±0.2 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

$\Gamma(\gamma f_0(980) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ **Γ_{272} / Γ**
 VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT NODE=M070P91
 NODE=M070P91

• • • We do not use the following data for averages, fits, limits, etc. • • •
 0.8±0.3 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

$\Gamma(\gamma \rho \rho) / \Gamma_{\text{total}}$ **Γ_{273} / Γ**
 VALUE (units 10^{-3}) CL% DOCUMENT ID TECN COMMENT NODE=M070R94
 NODE=M070R94

4.5 ± 0.8 OUR AVERAGE

4.7 ± 0.3 ± 0.9	1	BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
3.75±1.05±1.20	2	BURKE	82	MRK2 $J/\psi \rightarrow 4\pi\gamma$
<0.09	90	3 BISELLO	89B	$J/\psi \rightarrow 4\pi\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1 4π mass less than 2.0 GeV.
 2 4π mass less than 2.0 GeV. We have multiplied $2\rho^0$ measurement by 3 to obtain 2ρ .
 3 4π mass in the range 2.0–25 GeV.

NODE=M070R94;LINKAGE=N
 NODE=M070R94;LINKAGE=M
 NODE=M070R94;LINKAGE=A

$\Gamma(\gamma \rho \omega) / \Gamma_{\text{total}}$ **Γ_{274} / Γ**
 VALUE CL% DOCUMENT ID TECN COMMENT NODE=M070R05
 NODE=M070R05

<5.4 × 10⁻⁴ 90 ABLIKIM 08A BES2 $e^+ e^- \rightarrow J/\psi$

$\Gamma(\gamma \rho \phi) / \Gamma_{\text{total}}$ **Γ_{275} / Γ**
 VALUE CL% DOCUMENT ID TECN COMMENT NODE=M070R06
 NODE=M070R06

<8.8 × 10⁻⁵ 90 ABLIKIM 08A BES2 $e^+ e^- \rightarrow J/\psi$

$\Gamma(\gamma \omega \omega) / \Gamma_{\text{total}}$ **Γ_{276} / Γ**
 VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT NODE=M070R97
 NODE=M070R97

1.61 ± 0.33 OUR AVERAGE

6.0 ± 4.8 ± 1.8		ABLIKIM	08A	BES2	$J/\psi \rightarrow \gamma \omega \pi^+ \pi^-$
1.41 ± 0.2 ± 0.42	120 ± 17	BISELLO	87	SPEC	$e^+ e^-$, hadrons γ
1.76 ± 0.09 ± 0.45		BALTRUSAIT..85C	MRK3		$e^+ e^- \rightarrow$ hadrons γ

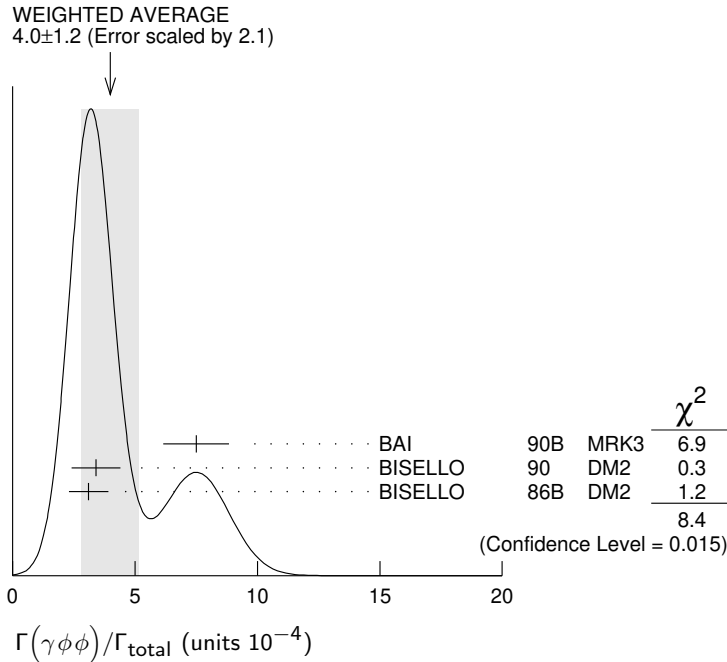
$\Gamma(\gamma\phi\phi)/\Gamma_{\text{total}}$ Γ_{277}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 1.2	OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.		
$7.5 \pm 0.6 \pm 1.2$	168	BAI	90B MRK3	$J/\psi \rightarrow \gamma 4K$
$3.4 \pm 0.8 \pm 0.6$	33 ± 7	¹ BISELLO	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.1 \pm 0.7 \pm 0.4$		¹ BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ $\phi\phi$ mass less than 2.9 GeV, η_c excluded.

NODE=M070R98
NODE=M070R98

NODE=M070R98;LINKAGE=C

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{278}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.6	OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.	
$1.66 \pm 0.1 \pm 0.58$	^{1,2} BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$3.8 \pm 0.3 \pm 0.6$	³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$4.0 \pm 0.7 \pm 1.0$	³ EDWARDS	82E CBAL	$J/\psi \rightarrow K^+ K^- \pi^0 \gamma$
4.3 ± 1.7	^{3,4} SCHARRE	80 MRK2	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.78 \pm 0.21 \pm 0.33$	^{3,5,6} AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$0.83 \pm 0.13 \pm 0.18$	^{3,7,8} AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$0.66^{+0.17+0.24}_{-0.16-0.15}$	^{3,6,9} BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$1.03^{+0.21+0.26}_{-0.18-0.19}$	^{3,8,10} BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

¹ Interference with the $J/\psi(1S)$ radiative transition to the broad $K \bar{K} \pi$ pseudoscalar state around 1800 is $(0.15 \pm 0.01 \pm 0.05) \times 10^{-3}$.

² Interference with $J/\psi \rightarrow \gamma f_1(1420)$ is $(-0.03 \pm 0.01 \pm 0.01) \times 10^{-3}$.

³ Includes unknown branching fraction $\eta(1405) \rightarrow K \bar{K} \pi$.

⁴ Corrected for spin-zero hypothesis for $\eta(1405)$.

⁵ From fit to the $a_0(980) \pi 0^- +$ partial wave.

⁶ $a_0(980) \pi$ mode.

⁷ From fit to the $K^*(892) K 0^- +$ partial wave.

⁸ $K^* K$ mode.

⁹ From $a_0(980) \pi$ final state.

¹⁰ From $K^*(890) K$ final state.

NODE=M070R89
NODE=M070R89

OCCUR=2

OCCUR=2

NODE=M070R89;LINKAGE=BD

NODE=M070R89;LINKAGE=BE

NODE=M070R89;LINKAGE=B

NODE=M070R89;LINKAGE=C

NODE=M070R89;LINKAGE=H

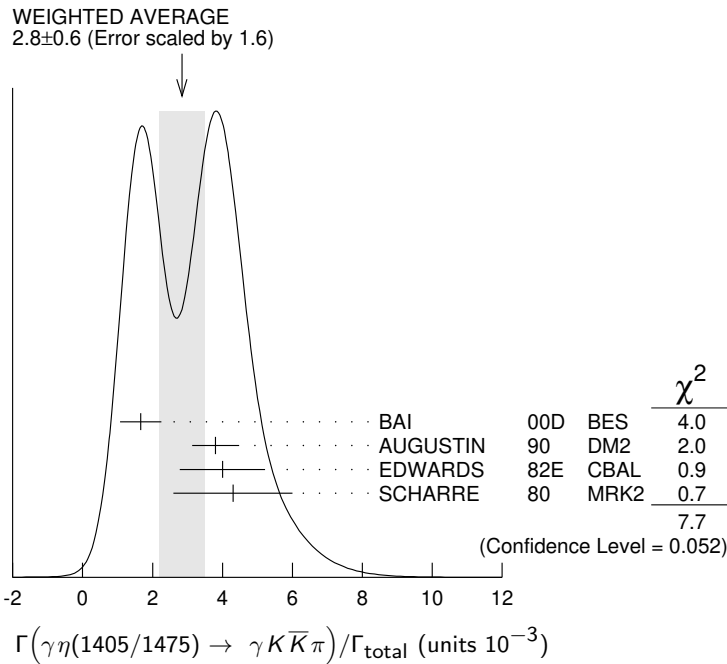
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NODE=M070R89;LINKAGE=J

NODE=M070R89;LINKAGE=K8

NODE=M070R89;LINKAGE=D

NODE=M070R89;LINKAGE=E



$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0) / \Gamma_{\text{total}}$

Γ_{279} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.78 ± 0.20 OUR AVERAGE	Error includes scale factor of 1.8.		
1.07 ± 0.17 ± 0.11	¹ BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
0.64 ± 0.12 ± 0.07	¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M070S30
NODE=M070S30

¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.

NODE=M070S30;LINKAGE=C

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-) / \Gamma_{\text{total}}$

Γ_{280} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.5 OUR AVERAGE				
2.6 ± 0.7 ± 0.4		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
3.38 ± 0.33 ± 0.64		¹ BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M070S29
NODE=M070S29

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.0 ± 0.6 ± 1.1 261 ²AUGUSTIN 90 DM2 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

¹ Via $a_0(980)\pi$.

² Includes unknown branching fraction to $\eta\pi^+\pi^-$.

NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0) / \Gamma_{\text{total}}$

Γ_{281} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.3.		
2.1 ± 0.4	BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1.36 ± 0.38	^{1,2} BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070S19
NODE=M070S19

¹ Estimated by us from various fits.

² Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S19;LINKAGE=A
NODE=M070S19;LINKAGE=B

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi) / \Gamma_{\text{total}}$

Γ_{282} / Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 82	95		BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma K^+ K^-$
7.03 ± 0.92 ± 0.91	1.3k		¹ ABLIKIM	18i BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
10.36 ± 1.51 ± 1.54	1.9k		² ABLIKIM	18i BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$

NODE=M070R77
NODE=M070R77

¹ Constructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

² Destructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

OCCUR=2

NODE=M070R77;LINKAGE=B

NODE=M070R77;LINKAGE=A

$\Gamma(\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0) / \Gamma_{\text{total}}$

Γ_{283} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.5 ± 0.11 ± 0.11	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma\eta(1405)$

NODE=M070Q76
NODE=M070Q76

$$\Gamma(\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^0\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{284}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.10 \pm 0.82 \pm 0.72$	198	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma\eta(1405)$

NODE=M070Q77
NODE=M070Q77

$$\Gamma(\gamma\eta(1405) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{285}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.63 \times 10^{-6}$	90	ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M070P38
NODE=M070P38

$$\Gamma(\gamma\eta(1475) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{286}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.86 \times 10^{-6}$	90	ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M070P39
NODE=M070P39

$$\Gamma(\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}} \quad \Gamma_{287}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.13 ± 0.09	1,2 BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070S20
NODE=M070S20

¹ Estimated by us from various fits.

² Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B

$$\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}} \quad \Gamma_{288}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.98 \pm 0.08 \pm 0.32$	1045	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$

NODE=M070R04
NODE=M070R04

$$\Gamma(\gamma\eta(1760) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{289}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.80 \times 10^{-6}$	90	ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M070P40
NODE=M070P40

$$\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}} \quad \Gamma_{290}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.14^{+0.50}_{-0.19}$	OUR AVERAGE			

NODE=M070S21
NODE=M070S21

$2.40 \pm 0.10^{+2.47}_{-0.18}$	1,2	ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$4.4 \pm 0.4 \pm 0.8$	196	2 ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.3 \pm 0.8 \pm 0.5$		2 BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$2.7 \pm 0.6 \pm 0.6$		2 BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$2.4^{+1.5}_{-1.0}$	3,4	BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

OCCUR=2

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$ that also finds significant signals for for $\eta(2100)$, 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M070S21;LINKAGE=C

² Includes unknown branching fraction to $\phi\phi$.

³ Estimated by us from various fits.

⁴ Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S21;LINKAGE=U
NODE=M070S21;LINKAGE=A
NODE=M070S21;LINKAGE=B

$$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}} \quad \Gamma_{291}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.63 ± 0.12	OUR AVERAGE			Error includes scale factor of 1.3. See the ideogram below.

NODE=M070R86
NODE=M070R86

$2.07 \pm 0.16^{+0.02}_{-0.07}$	2.4k	1,2 DOBBS	15	$J/\psi \rightarrow \gamma\pi\pi$
$1.63 \pm 0.26^{+0.02}_{-0.05}$		3 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
$1.42 \pm 0.21^{+0.02}_{-0.05}$		4 ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^0\pi^0$
$1.33 \pm 0.05 \pm 0.20$		5 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
$1.36 \pm 0.09 \pm 0.23$		5 BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
$1.48 \pm 0.25 \pm 0.30$	178	EDWARDS	82B CBAL	$e^+e^- \rightarrow 2\pi^0\gamma$
2.0 ± 0.7	35	ALEXANDER	78 PLUT	e^+e^-
1.2 ± 0.6	30	6 BRANDELIK	78B DASP	$e^+e^- \rightarrow \pi^+\pi^-\gamma$

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(J/\psi(15) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.744 \pm 0.052 \pm 0.122) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R86;LINKAGE=A
NODE=M070R86;LINKAGE=DO

³ ABLIKIM 06V reports $[\Gamma(J/\psi(15) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.371 \pm 0.010 \pm 0.222) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi)$

NODE=M070R86;LINKAGE=AI

$= (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{total}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.200 \pm 0.027 \pm 0.174) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

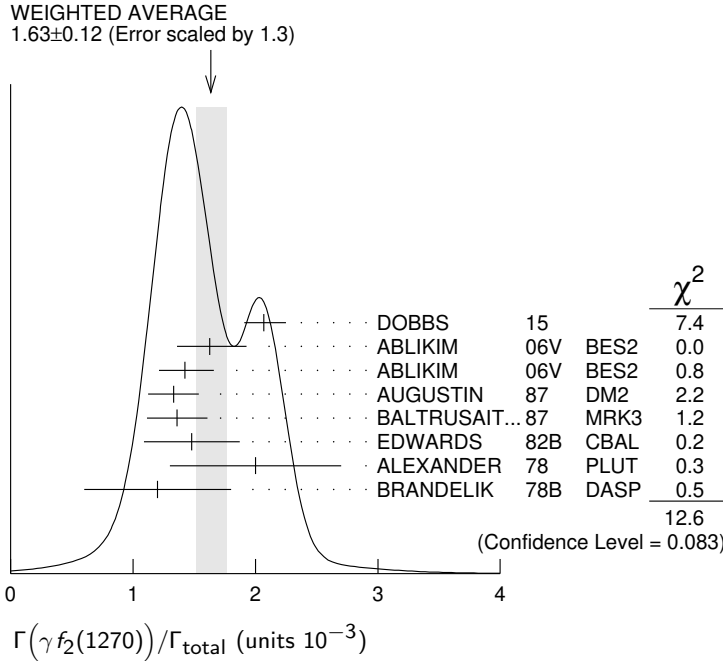
⁵ Estimated using $B(f_2(1270) \rightarrow \pi\pi) = 0.843 \pm 0.012$. The errors do not contain the uncertainty in the $f_2(1270)$ decay.

⁶ Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=AL

NODE=M070R86;LINKAGE=X

NODE=M070R86;LINKAGE=T



$\Gamma(\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{total}$	Γ_{292}/Γ		
VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$2.58^{+0.08+0.59}_{-0.09-0.20}$	ABLIKIM	18AA	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P68
NODE=M070P68

$\Gamma(\gamma f_1(1285))/\Gamma_{total}$	Γ_{293}/Γ		
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.61 ± 0.08 OUR AVERAGE			
0.69 $\pm 0.16 \pm 0.20$	1 BAI	04J	BES2 $J/\psi \rightarrow \gamma \gamma \rho^0$
0.61 $\pm 0.04 \pm 0.21$	2 BAI	00D	BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
0.45 $\pm 0.09 \pm 0.17$	3 BAI	99	BES $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
0.625 $\pm 0.063 \pm 0.103$	4 BOLTON	92	MRK3 $J/\psi \rightarrow \gamma f_1(1285)$
0.70 $\pm 0.08 \pm 0.16$	5 BOLTON	92B	MRK3 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M070R88
NODE=M070R88

- Assuming $B(f_1(1285) \rightarrow \rho^0 \gamma) = 0.055 \pm 0.013$.
- Assuming $\Gamma(f_1(1285) \rightarrow K \bar{K} \pi)/\Gamma_{total} = 0.090 \pm 0.004$.
- Assuming $\Gamma(f_1(1285) \rightarrow \eta \pi \pi)/\Gamma_{total} = 0.5 \pm 0.18$.
- Obtained summing the sequential decay channels
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \pi \pi \pi \pi) = (1.44 \pm 0.39 \pm 0.27) \times 10^{-4}$;
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow \eta \pi) = (3.90 \pm 0.42 \pm 0.87) \times 10^{-4}$;
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow K \bar{K}) = (0.66 \pm 0.26 \pm 0.29) \times 10^{-4}$;
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \gamma \rho^0) = (0.25 \pm 0.07 \pm 0.03) \times 10^{-4}$.
- Using $B(f_1(1285) \rightarrow a_0(980) \pi) = 0.37$, and including unknown branching ratio for $a_0(980) \rightarrow \eta \pi$.

NODE=M070R88;LINKAGE=BI
NODE=M070R88;LINKAGE=BD
NODE=M070R88;LINKAGE=BA
NODE=M070R88;LINKAGE=B

NODE=M070R88;LINKAGE=A

$\Gamma(\gamma f_0(1370) \rightarrow \gamma \pi \pi)/\Gamma_{total}$	Γ_{294}/Γ		
VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
38 ± 10	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

NODE=M070P92
NODE=M070P92

••• We do not use the following data for averages, fits, limits, etc. •••

$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{295}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.19\pm0.73\pm1.34	478	¹ DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.3 \pm 0.4	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R00
NODE=M070R00

NODE=M070R00;LINKAGE=A

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{296}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.07$^{+0.08+0.36}$$_{-0.07-0.34}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P63
NODE=M070P63

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{297}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.5 \pm 1.0	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070P93
NODE=M070P93

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{298}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.9 \pm 0.3	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070P94
NODE=M070P94

 $\Gamma(\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{299}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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0.79 \pm 0.13 OUR AVERAGE

0.68 \pm 0.04 \pm 0.24	BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
0.76 \pm 0.15 \pm 0.21	^{1,2} AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
0.87 \pm 0.14 $^{+0.14}$ $_{-0.11}$	¹ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M070S31
NODE=M070S31

OCCUR=2

¹ Included unknown branching fraction $f_1(1420) \rightarrow K \bar{K} \pi$.

² From fit to the $K^*(892)K 1^{++}$ partial wave.

NODE=M070S31;LINKAGE=A
NODE=M070S31;LINKAGE=D

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{300}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.09 \pm 0.24 OUR AVERAGE

1.21 \pm 0.29 \pm 0.24	174	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
1.00 \pm 0.03 \pm 0.45		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1.02 \pm 0.09 \pm 0.45		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.90 \pm 0.17	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
5.7 \pm 0.8	^{3,4} BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$

NODE=M070S32
NODE=M070S32

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Including unknown branching fraction to $\pi\pi$.

³ Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.

⁴ Assuming that $f_0(1500)$ decays only to two S -wave dipions.

NODE=M070S32;LINKAGE=C
NODE=M070S32;LINKAGE=AB
NODE=M070S32;LINKAGE=A
NODE=M070S32;LINKAGE=B

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{301}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.65$^{+0.26+0.51}$$_{-0.31-1.40}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.1 \pm 0.4	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S83
NODE=M070S83

NODE=M070S83;LINKAGE=A

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{302}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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1.59\pm0.16$^{+0.18}$$_{-0.56}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.7 \pm 0.3	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070P64
NODE=M070P64

$\Gamma(\gamma f_0(1500) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$ Γ_{303} / Γ

VALUE (units 10^{-6}) DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$18.1 \pm 1.1^{+1.9}_{-1.3}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
12 ± 5	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070P99
NODE=M070P99

NODE=M070P99;LINKAGE=A

$\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{304} / Γ

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

$4.5 \pm 1.0 \pm 0.7$	BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
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NODE=M070S36
NODE=M070S36

$\Gamma(\gamma f'_2(1525)) / \Gamma_{\text{total}}$ Γ_{305} / Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

$5.7^{+0.8}_{-0.5}$ OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

$8.0 \pm 0.9 \pm 0.2$	750	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$	
$3.85 \pm 0.17^{+1.91}_{-0.73}$		³ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$	
$3.6 \pm 0.4^{+1.4}_{-0.4}$		³ BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$	
$5.6 \pm 1.4 \pm 0.9$		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=3
$4.5 \pm 0.4 \pm 0.9$		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$	OCCUR=4
$6.8 \pm 1.6 \pm 1.4$		³ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.4	90	4	⁴ BRANDELIK	79C DASP	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
<2.3	90	3	ALEXANDER	78 PLUT	$e^+ e^- \rightarrow K^+ K^- \gamma$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f'_2(1525)) / \Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] = (7.09 \pm 0.46 \pm 0.67) \times 10^{-4}$ which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(f'_2(1525) \rightarrow K\bar{K}) = 0.888$.

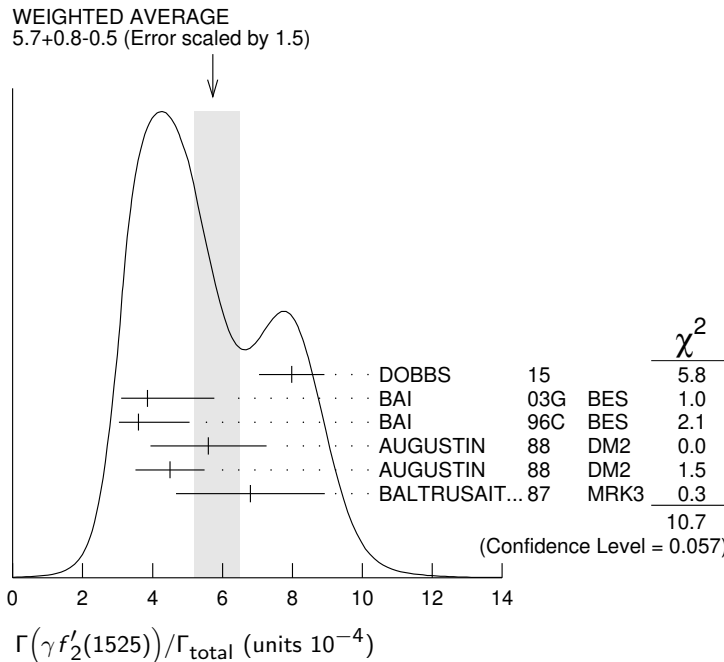
⁴ Assuming isotropic production and decay of the $f'_2(1525)$ and isospin.

NODE=M070R87
NODE=M070R87

OCCUR=3
OCCUR=4
OCCUR=2

NODE=M070R87;LINKAGE=B
NODE=M070R87;LINKAGE=DO

NODE=M070R87;LINKAGE=A1
NODE=M070R87;LINKAGE=I



$\Gamma(\gamma f'_2(1525) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{306} / Γ

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

$7.99^{+0.03+0.69}_{-0.04-0.50}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
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NODE=M070P69
NODE=M070P69

$\Gamma(\gamma f_2'(1525) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{307} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.42^{+0.43+1.37}_{-0.51-1.30}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S86
NODE=M070S86

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S86;LINKAGE=A

 $\Gamma(\gamma f_2(1565) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$ Γ_{308} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.32 \pm 0.05^{+0.12}_{-0.02}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

NODE=M070Q31
NODE=M070Q31

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q31;LINKAGE=A

 $\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{309} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.28 \pm 0.05 \pm 0.17$	141	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R02
NODE=M070R02 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{310} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.5 OUR AVERAGE				

NODE=M070B01
NODE=M070B01

$3.72 \pm 0.30 \pm 0.43$	483	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
$3.96 \pm 0.06 \pm 1.12$		² ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$3.99 \pm 0.15 \pm 2.64$		² ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 ± 0.2		³ SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
$2.5 \pm 1.6 \pm 0.8$		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Including unknown branching fraction to $\pi \pi$.

³ There is a further $(2.4 \pm 0.8) \times 10^{-4}$ scalar contribution at 1765 MeV.

NODE=M070B01;LINKAGE=A
NODE=M070B01;LINKAGE=A
NODE=M070B01;LINKAGE=B $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{311} / Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.5 ± 1.0					

NODE=M070R91
NODE=M070R91

9.5 ± 1.0 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

$8.00 \pm 0.12^{+1.24}_{-0.08-0.40}$		¹ ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$11.76 \pm 0.54 \pm 0.94$	1.2k	² DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$
$9.62 \pm 0.29 \pm 3.51_{-1.86}$		³ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$5.0 \pm 0.8 \pm 1.8_{-0.4}$		^{1,4} BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
$9.2 \pm 1.4 \pm 1.4$		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
$10.4 \pm 1.2 \pm 1.6$		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$9.6 \pm 1.2 \pm 1.8$		¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ± 0.8		⁵ SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
$1.6 \pm 0.2 \pm 0.6_{-0.2}$		^{1,6} BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
< 0.8	90	⁷ BISELLO	89B	$J/\psi \rightarrow 4\pi \gamma$
$1.6 \pm 0.4 \pm 0.3$		⁸ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.8 ± 1.6		⁹ EDWARDS	82D CBAL	$e^+ e^- \rightarrow \eta \eta \gamma$

OCCUR=2

OCCUR=2

¹ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$. We have multiplied $K^+ K^-$ measurement by 2, and $K_S^0 K_S^0$ by 4 to obtain $K \bar{K}$ result.

NODE=M070R91;LINKAGE=B

² Using CLEO-c data but not authored by the CLEO Collaboration.

³ Includes unknown branching ratio to $K^+ K^-$ or $K_S^0 K_S^0$.

⁴ Assuming $J^P = 2^+$ for $f_0(1710)$.

⁵ There is a further $(6 \pm 2) \times 10^{-4}$ scalar contribution at 1765 MeV.

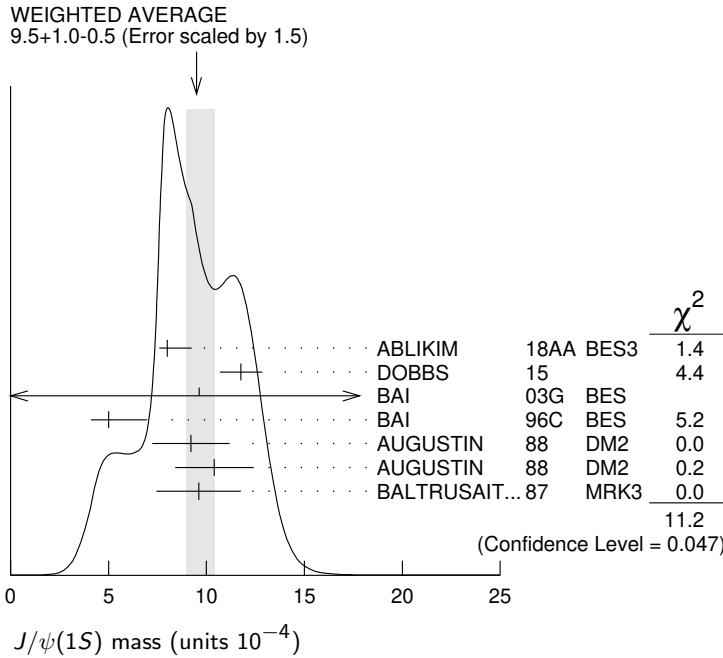
⁶ Assuming $J^P = 0^+$ for $f_0(1710)$.

⁷ Includes unknown branching fraction to $\rho^0 \rho^0$.

⁸ Includes unknown branching fraction to $\pi^+ \pi^-$.

⁹ Includes unknown branching fraction to $\eta \eta$.

NODE=M070R91;LINKAGE=D
NODE=M070R91;LINKAGE=K9
NODE=M070R91;LINKAGE=A1
NODE=M070R91;LINKAGE=E
NODE=M070R91;LINKAGE=A2
NODE=M070R91;LINKAGE=C
NODE=M070R91;LINKAGE=Z
NODE=M070R91;LINKAGE=A



$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{total}$ Γ_{312} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.31 ± 0.06 ± 0.08	180	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R01
NODE=M070R01

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta) / \Gamma_{total}$ Γ_{313} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.13+1.24}_{-0.11-0.74}	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S84
NODE=M070S84

- • • We do not use the following data for averages, fits, limits, etc. • • •
- 1.2 ± 0.4 ² SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S84;LINKAGE=A

² There is a further $(0.7 \pm 0.1) \times 10^{-4}$ scalar contribution at 1765 MeV.

NODE=M070S84;LINKAGE=B

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta') / \Gamma_{total}$ Γ_{314} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.5 ± 2.5	¹ SARANTSEV 21 RVUE		$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070Q00
NODE=M070Q00

¹ There is a further $(2.5 \pm 1.1) \times 10^{-5}$ scalar contribution at 1765 MeV.

NODE=M070Q00;LINKAGE=A

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \phi) / \Gamma_{total}$ Γ_{315} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.6 OUR AVERAGE				
2.00 ± 0.08 ^{+1.38} _{-1.64}	1.3k	ABLIKIM	13J BES3	$J/\psi \rightarrow \gamma \omega \phi$
2.61 ± 0.27 ± 0.65	95	ABLIKIM	06J BES2	$J/\psi \rightarrow \gamma \omega \phi$

NODE=M070S79
NODE=M070S79

- • • We do not use the following data for averages, fits, limits, etc. • • •
- 0.1 ± 0.1 ¹ SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

¹ There is a further $(2.2 \pm 0.4) \times 10^{-4}$ scalar contribution at 1765 MeV.

NODE=M070S79;LINKAGE=A

$\Gamma(\gamma f_0(1770) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{total}$ Γ_{316} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.11 ± 0.06^{+0.19}_{-0.32}	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P65
NODE=M070P65

$\Gamma(\gamma f_2(1810) \rightarrow \gamma \eta \eta) / \Gamma_{total}$ Γ_{317} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
5.40^{+0.60+3.42}_{-0.67-2.35}	5.5k	¹ ABLIKIM	13N $J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S87
NODE=M070S87

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S87;LINKAGE=A

$\Gamma(\gamma\eta_1(1855) \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ Γ_{318}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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$2.70 \pm 0.41^{+0.16}_{-0.35}$	¹ ABLIKIM	22A1	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
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¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave. For analysis details see ABLIKIM 22AS.

NODE=M070Q44
NODE=M070Q44

NODE=M070Q44;LINKAGE=A

 $\Gamma(\gamma f_0(1770) \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ Γ_{319}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.11 \pm 0.01^{+0.04}_{-0.03}$	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
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¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave.

NODE=M070Q30
NODE=M070Q30

NODE=M070Q30;LINKAGE=A

 $\Gamma(\gamma f_2(1910) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{320}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$0.20 \pm 0.04 \pm 0.13$	151	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$
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NODE=M070R03
NODE=M070R03 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{321}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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$0.7 \pm 0.1 \pm 0.2$	BAI	00B	BES $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$
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NODE=M070B06
NODE=M070B06 $\Gamma(\gamma f_2(2010) \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ Γ_{322}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.71 \pm 0.06^{+0.10}_{-0.06}$	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
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¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave.

NODE=M070Q37
NODE=M070Q37

NODE=M070Q37;LINKAGE=A

 $\Gamma(\gamma f_0(2020) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{323}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

42 ± 10	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070Q01
NODE=M070Q01 $\Gamma(\gamma f_0(2020) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{324}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

55 ± 25	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070Q02
NODE=M070Q02 $\Gamma(\gamma f_0(2020) \rightarrow \gamma\eta\eta)/\Gamma_{\text{total}}$ Γ_{325}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

10 ± 10	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
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NODE=M070Q03
NODE=M070Q03 $\Gamma(\gamma f_0(2020) \rightarrow \gamma\eta'\eta')/\Gamma_{\text{total}}$ Γ_{326}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
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$2.63 \pm 0.06^{+0.31}_{-0.46}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$
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¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q25
NODE=M070Q25

NODE=M070Q25;LINKAGE=A

 $\Gamma(\gamma f_0(2020) \rightarrow \gamma\eta\eta')/\Gamma_{\text{total}}$ Γ_{327}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.28 \pm 0.12^{+0.29}_{-0.20}$	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
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¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave.

NODE=M070Q35
NODE=M070Q35

NODE=M070Q35;LINKAGE=A

$\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ Γ_{328}/Γ VALUE (units 10^{-3})

DOCUMENT ID TECN COMMENT

 $2.7 \pm 0.5 \pm 0.5$ ¹ BALTRUSAIT..87 MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$ ¹ Assuming branching fraction $f_4(2050) \rightarrow \pi \pi / \text{total} = 0.167$.NODE=M070S7
NODE=M070S7

NODE=M070S7;LINKAGE=V

 $\Gamma(\gamma f_4(2050) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{329}/Γ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $0.06 \pm 0.01^{+0.03}_{-0.01}$ ¹ ABLIKIM 22AS BES3 $J/\psi(1S) \rightarrow \gamma \eta \eta'$ ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.NODE=M070Q32
NODE=M070Q32

NODE=M070Q32;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{330}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID TECN COMMENT

 $1.13^{+0.09+0.64}_{-0.10-0.28}$

5.5k

¹ ABLIKIM 13N BES3 $J/\psi \rightarrow \gamma \eta \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 1.8 ± 1.5 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.NODE=M070S85
NODE=M070S85

NODE=M070S85;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{331}/Γ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 32 ± 20 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q04
NODE=M070Q04 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{332}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID TECN COMMENT

 $6.24 \pm 0.48 \pm 0.87$

744

¹ DOBBS 15 $J/\psi \rightarrow \gamma \pi \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 2.0 ± 0.8 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M070B08
NODE=M070B08

NODE=M070B08;LINKAGE=A

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{333}/Γ VALUE (units 10^{-4})

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.5

¹ AUGUSTIN 88 DM2 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ ¹ Includes unknown branching fraction to $K_S^0 K_S^0$.NODE=M070S18
NODE=M070S18

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{334}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID TECN COMMENT

 $5.86 \pm 0.49 \pm 1.20$

490

¹ DOBBS 15 $J/\psi \rightarrow \gamma K\bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 0.5 ± 0.5 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M070B09
NODE=M070B09

NODE=M070B09;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{335}/Γ VALUE (units 10^{-4})

DOCUMENT ID TECN COMMENT

 $2.72^{+0.08+0.17}_{-0.06-0.47}$ ABLIKIM 18AA BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ NODE=M070P66
NODE=M070P66 $\Gamma(\gamma f_0(2200) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{336}/Γ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 5 ± 2 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q05
NODE=M070Q05 $\Gamma(\gamma f_0(2200) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{337}/Γ VALUE (units 10^{-5})

DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 0.7 ± 0.4 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q06
NODE=M070Q06

$\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{338}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R92
 NODE=M070R92

• • • We do not use the following data for averages, fits, limits, etc. • • •

>300			¹ BAI	96B BES	$e^+e^- \rightarrow \gamma \bar{p}p, K\bar{K}$
>250	99.9		² HASAN	96 SPEC	$\bar{p}p \rightarrow \pi^+\pi^-$
< 2.3	95		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+K^-$
< 1.6	95		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$12.4^{+6.4}_{-5.2} \pm 2.8$		23	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$8.4^{+3.4}_{-2.8} \pm 1.6$		93	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K^+K^-$

OCCUR=2

OCCUR=2

¹ Using BARNES 93.

² Using BAI 96B.

³ Includes unknown branching fraction to K^+K^- or $K_S^0 K_S^0$.

NODE=M070R92;LINKAGE=A
 NODE=M070R92;LINKAGE=M
 NODE=M070R92;LINKAGE=W

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{339}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070B02
 NODE=M070B02

< 3.9 90 ^{1,2} DOBBS 15 $J/\psi \rightarrow \gamma \pi \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$14 \pm 8 \pm 4$		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$
$8.4 \pm 2.6 \pm 3.0$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+\pi^-$ and $\pi^0\pi^0$ are $2.6/5.2 \times 10^{-5}$ and $1.3/1.9 \times 10^{-5}$, respectively.

NODE=M070B02;LINKAGE=A
 NODE=M070B02;LINKAGE=DO

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{340}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070B03
 NODE=M070B03

< 4.1 90 ^{1,2} DOBBS 15 $J/\psi \rightarrow \gamma K \bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3.6		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
< 2.9		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.6 \pm 2.9 \pm 2.4$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+K^-$
$10.8 \pm 4.0 \pm 3.2$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$

OCCUR=2

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for K^+K^- and $K_S^0 K_S^0$ are $1.7/3.1 \times 10^{-5}$ and $1.2/2.0 \times 10^{-5}$, respectively.

³ For spin 2 and helicity 0; other combinations lead to more stringent upper limits.

NODE=M070B03;LINKAGE=A
 NODE=M070B03;LINKAGE=DO

NODE=M070B03;LINKAGE=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{341}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070B04
 NODE=M070B04

$1.5 \pm 0.6 \pm 0.5$ BAI 96B BES $e^+e^- \rightarrow J/\psi \rightarrow \gamma p \bar{p}$

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{342}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070P67
 NODE=M070P67

$4.95 \pm 0.21^{+0.66}_{-0.72}$ ABLIKIM 18AA BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 \pm 0.1 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{343}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q07
 NODE=M070Q07

• • • We do not use the following data for averages, fits, limits, etc. • • •

4 ± 2 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{344}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q08
 NODE=M070Q08

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.5 ± 0.4 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

$$\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}} \quad \Gamma_{345} / \Gamma$$

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
$6.09 \pm 0.64^{+4.00}_{-1.68}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M070Q26
NODE=M070Q26

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q26;LINKAGE=A

$$\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}} \quad \Gamma_{346} / \Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.10 \pm 0.02^{+0.01}_{-0.02}$	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma \eta \eta'$

NODE=M070Q36
NODE=M070Q36

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

NODE=M070Q36;LINKAGE=A

$$\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}} \quad \Gamma_{347} / \Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.60^{+0.62+2.37}_{-0.65-2.07}$	5.5k	¹ ABLIKIM	13N	BES3 $J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S88
NODE=M070S88

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S88;LINKAGE=A

$$\Gamma(\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}} \quad \Gamma_{348} / \Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$5.54^{+0.34+3.82}_{-0.40-1.49}$	ABLIKIM	18AA	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P70
NODE=M070P70

$$\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}} \quad \Gamma_{349} / \Gamma$$

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
$8.67 \pm 0.70^{+0.61}_{-1.67}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M070Q29
NODE=M070Q29

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q29;LINKAGE=A

$$\Gamma(\gamma f_0(2470) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}} \quad \Gamma_{350} / \Gamma$$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
$8.18 \pm 1.77^{+3.73}_{-2.23}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M070Q27
NODE=M070Q27

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q27;LINKAGE=A

$$\Gamma(\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \quad \Gamma_{351} / \Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.7^{+0.6}_{-0.8}$		OUR AVERAGE Error includes scale factor of 1.6.		

NODE=M070R78
NODE=M070R78

$3.93 \pm 0.38^{+0.31}_{-0.84}$	¹ ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
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$2.2 \pm 0.4 \pm 0.4$	264	ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.87 \pm 0.09^{+0.49}_{-0.52}$	4265	² ABLIKIM	11C	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
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NODE=M070R78;LINKAGE=A

¹ From a fit of the measured $\pi^+ \pi^- \eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the $X(1835)$; fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

² From a fit of the $\pi^+ \pi^- \eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma \eta(2370)$, for $M(\pi^+ \pi^- \eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0 \pi^+ \pi^- \eta'$.

NODE=M070R78;LINKAGE=A

$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{352}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S71
NODE=M070S71

0.77^{+0.15}_{-0.09} OUR AVERAGE

0.90 ^{+0.04+0.27} _{-0.11-0.55}		1 ABLIKIM	12D	BES3	$J/\psi \rightarrow \gamma p \bar{p}$
1.14 ^{+0.43+0.42} _{-0.30-0.26}	231	2 ALEXANDER	10	CLEO	$J/\psi \rightarrow \gamma p \bar{p}$
0.70 \pm 0.04 ^{+0.19} _{-0.08}		BAI	03F	BES2	$J/\psi \rightarrow \gamma p \bar{p}$

¹ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A.

² From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M070S71;LINKAGE=AK

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta)/\Gamma_{\text{total}}$ Γ_{353}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070S96
NODE=M070S96

3.31^{+0.33+1.96}_{-0.30-1.29}	ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
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 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \phi(1020))/\Gamma_{\text{total}}$ Γ_{354}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070P37
NODE=M070P37

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.77 \pm 0.35 \pm 0.25	305	1 ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
8.09 \pm 1.99 \pm 1.36	1.3k	2 ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$

OCCUR=2

¹ Constructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

NODE=M070P37;LINKAGE=A

² Destructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

NODE=M070P37;LINKAGE=B

 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \gamma)/\Gamma_{\text{total}}$ Γ_{355}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070P41
NODE=M070P41

$<3.56 \times 10^{-6}$	90	ABLIKIM	180	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$
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 $\Gamma(\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{356}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070S82
NODE=M070S82

2.44\pm0.36^{+0.60}_{-0.74}	0.6k	ABLIKIM	13U	BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$
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 $\Gamma(\gamma \eta(2370) \rightarrow \gamma K^+ K^- \eta')/\Gamma_{\text{total}}$ Γ_{357}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070P86
NODE=M070P86

1.79\pm0.23\pm0.65	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K^+ K^- \eta'$
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 $\Gamma(\gamma \eta(2370) \rightarrow \gamma K_S^0 K_S^0 \eta')/\Gamma_{\text{total}}$ Γ_{358}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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NODE=M070P87
NODE=M070P87

1.18\pm0.32\pm0.39	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.31 \pm 0.22 ^{+2.85} _{-0.84}	1 ABLIKIM	24	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$
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¹ Decaying via the intermediate $f_0(980)\eta'$, fitted together with $X(1835)$, a 600 MeV broad structure around 2.8 GeV, and the tail of the $\eta_c(1S)$.

NODE=M070P87;LINKAGE=A

 $\Gamma(\gamma \eta(2370) \rightarrow \gamma \eta \eta \eta')/\Gamma_{\text{total}}$ Γ_{359}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070P88
NODE=M070P88

$<9.2 \times 10^{-6}$	90	ABLIKIM	21C	BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta \eta'$
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 $\Gamma(\gamma D^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{360}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M070Q79
NODE=M070Q79

$<9.1 \times 10^{-8}$	90	ABLIKIM	24BZ	BES3	$e^+ e^- \rightarrow J/\psi(1S)$
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 $\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{361}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M070R90
NODE=M070R90

0.38\pm0.07\pm0.07	49	EATON	84	MRK2	$e^+ e^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.11	90	PERUZZI	78	MRK1	$e^+ e^-$
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$\Gamma(\gamma\rho\bar{\rho}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{362}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.79 \times 10^{-3}$	90	EATON	84	MRK2 e^+e^-

NODE=M070R93
 NODE=M070R93

 $\Gamma(\gamma\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{363}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.13 \times 10^{-3}$	90	HENRARD	87	DM2 e^+e^-
$<0.16 \times 10^{-3}$	90	BAI	98G	BES e^+e^-

NODE=M070S8
 NODE=M070S8

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$ Γ_{364}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-6}$	90	88M	¹ ABLIKIM	20K	BES3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
$<6.3 \times 10^{-6}$	90	3.7M	² INSLER	10	CLEO $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$

NODE=M070S68
 NODE=M070S68

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ For a narrow state, A^0 , with mass $m_{A^0} < 1.2$ GeV. The limit varies with m_{A^0} , reaching its largest value of 1.7×10^{-6} at 1.2 GeV and being 7.0×10^{-7} for $m_{A^0} = 0$.

NODE=M070S68;LINKAGE=A

² The limit varies with mass m_{A^0} of a narrow state A^0 and is 4.3×10^{-6} for $m_{A^0} = 0$, reaches its largest value of 6.3×10^{-6} at $m_{A^0} = 500$ MeV, and is 3.6×10^{-6} at $m_{A^0} = 960$ MeV.

NODE=M070S68;LINKAGE=IN

 $\Gamma(\gamma A^0 \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{365}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.9 \times 10^{-7}$	95	¹ ABLIKIM	24AD	BES3 $J/\psi \rightarrow \gamma\gamma\gamma$
$<1.8 \times 10^{-6}$	95	² ABLIKIM	23E	BES3 $J/\psi \rightarrow \gamma\gamma\gamma$

NODE=M070Q68
 NODE=M070Q68

¹ For a light pseudoscalar axion-like particle, A^0 , with a mass in the range 0.18–2.85 GeV. The measured 95% CL limit as a function of m_{A^0} ranges from 3.7×10^{-8} to 4.85×10^{-7} .

NODE=M070Q68;LINKAGE=B

² For a light pseudoscalar axion-like particle, A^0 , with a mass in the range 0.165–2.84 GeV. The measured 95% CL limit as a function of m_{A^0} ranges from 8.3×10^{-8} to 1.8×10^{-6} .

NODE=M070Q68;LINKAGE=A

 $\Gamma(\gamma A^0 \rightarrow \gamma\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{366}/Γ (narrow state A^0 with $0.2 \text{ GeV} < m_{A^0} < 3 \text{ GeV}$)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	¹ ABLIKIM	22H	BES3 $J/\psi \rightarrow \gamma\mu^+\mu^-$
$<0.5 \times 10^{-5}$	90	² ABLIKIM	16E	BES3 $J/\psi \rightarrow \gamma\mu^+\mu^-$
$<2.1 \times 10^{-5}$	90	³ ABLIKIM	12	BES3 $J/\psi \rightarrow \gamma\mu^+\mu^-$

NODE=M070S76
 NODE=M070S76

¹ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.212–3.0 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(1.2\text{--}778.0) \times 10^{-9}$.

NODE=M070S76;LINKAGE=B

² For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.212–3 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(2.8\text{--}495.3) \times 10^{-8}$.

NODE=M070S76;LINKAGE=A

³ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.21–3.00 GeV. The measured 90% CL limit as a function of m_{A^0} ranges from 4×10^{-7} to 2.1×10^{-5} .

NODE=M070S76;LINKAGE=AB

————— DALITZ DECAYS —————

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{367}/Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.56 \pm 1.32 \pm 0.50$	39	ABLIKIM	14I	BES3 $J/\psi \rightarrow \pi^0 e^+ e^-$

NODE=M070330

NODE=M070S89
 NODE=M070S89

 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{368}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.42 \pm 0.04 \pm 0.07$	2.47k	^{1,2} ABLIKIM	19A	BES3 $J/\psi \rightarrow \eta e^+ e^-$
$1.16 \pm 0.07 \pm 0.06$	320	¹ ABLIKIM	14I	BES3 $J/\psi \rightarrow \eta e^+ e^-$

NODE=M070S90
 NODE=M070S90

¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decays.

NODE=M070S90;LINKAGE=A

² Approximation of the transition form factor squared as an incoherent sum of the ρ -meson and one-pole non-resonant amplitudes gives the pole mass $m(\Lambda) = 2.56 \pm 0.04 \pm 0.03$ GeV. Supersedes ABLIKIM 14I.

NODE=M070S90;LINKAGE=C

$\Gamma(\eta'(958)e^+e^-)/\Gamma_{\text{total}}$ Γ_{369}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.59±0.07±0.17	8.9k	¹ ABLIKIM	19H BES3	$J/\psi \rightarrow \eta'(958)e^+e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.81±0.16±0.31	1.4k	^{1,2} ABLIKIM	14I BES3	$J/\psi \rightarrow \eta'(958)e^+e^-$
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¹ Using both $\eta' \rightarrow \gamma\pi^+\pi^-$ and $\eta' \rightarrow \pi^+\pi^-\eta$ decays.

² Superseded by ABLIKIM 19H.

NODE=M070S91
NODE=M070S91

NODE=M070S91;LINKAGE=A
NODE=M070S91;LINKAGE=B

 $\Gamma(\eta(1405)e^+e^- \rightarrow f_0(980)\pi^0e^+e^- \rightarrow \pi^+\pi^-\pi^0e^+e^-)/\Gamma_{\text{total}}$ Γ_{370}/Γ

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
2.04±0.20±0.08	203	¹ ABLIKIM	24I BES3	$J/\psi \rightarrow e^+e^-\eta(1405)$

¹ With a significance of 9.8 σ .

NODE=M070Q75
NODE=M070Q75

OCCUR=2

NODE=M070Q75;LINKAGE=B

 $\Gamma(X(1835)e^+e^-, X \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{371}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.58±0.19±0.16	1364	¹ ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'e^+e^-$

¹ Assuming constructive interference. Destructive interference gives a value of $(4.43 \pm 0.23 \pm 0.19) \times 10^{-6}$ for this branching fraction.

NODE=M070Q22
NODE=M070Q22

NODE=M070Q22;LINKAGE=A

 $\Gamma(X(2120)e^+e^-, X \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{372}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
0.82±0.12±0.06	310	ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'e^+e^-$

NODE=M070Q24
NODE=M070Q24

 $\Gamma(\eta(2370)e^+e^-, \eta \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{373}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.08±0.14±0.10	397	ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'e^+e^-$

NODE=M070Q23
NODE=M070Q23

 $\Gamma(\eta U \rightarrow \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{374}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9.11 × 10⁻⁷	90	¹ ABLIKIM	19A BES3	$J/\psi \rightarrow \eta e^+e^-$

¹ For a dark photon U with mass between 10 and 2400 MeV. Obtained 90% C.L. limits as a function of m_U range from 1.9×10^{-8} to 91.1×10^{-8} .

NODE=M070P42
NODE=M070P42

NODE=M070P42;LINKAGE=A

 $\Gamma(\eta'(958)U \rightarrow \eta'(958)e^+e^-)/\Gamma_{\text{total}}$ Γ_{375}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0 × 10⁻⁷	90	¹ ABLIKIM	19H BES3	$J/\psi \rightarrow \eta'(958)e^+e^-$

¹ For a dark photon U with mass between 100 and 2100 MeV. Obtained 90% C.L. limits as a function of m_U range from 1.8×10^{-8} to 2.0×10^{-7} . The corresponding limits on the branching fraction $J/\psi \rightarrow \eta'U$ range from 5.7×10^{-8} to 7.4×10^{-7} .

NODE=M070P61
NODE=M070P61

NODE=M070P61;LINKAGE=A

 $\Gamma(\phi e^+e^-)/\Gamma_{\text{total}}$ Γ_{376}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ ABLIKIM	19AB BES3	$J/\psi \rightarrow \phi e^+e^-$

¹ Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\psi(2S) \rightarrow \pi^+\pi^-J/\psi) = (34.49 \pm 0.30)\%$.

NODE=M070P82
NODE=M070P82

NODE=M070P82;LINKAGE=A

———— WEAK DECAYS ————

 $\Gamma(D^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{377}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.1 × 10⁻⁸	90	ABLIKIM	21Q BES3	$e^+e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2 × 10 ⁻⁵	90	ABLIKIM	06M BES2	$e^+e^- \rightarrow J/\psi$
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NODE=M070320

NODE=M070S53
NODE=M070S53

 $\Gamma(D^- \mu^+ \nu_\mu + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{378}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.6 × 10⁻⁷	90	¹ ABLIKIM	24AMBES3	$e^+e^- \rightarrow J/\psi$

¹ Using $B(D^- \rightarrow K^+\pi^-\pi^-) = 9.38 \pm 0.16\%$.

NODE=M070Q67
NODE=M070Q67

NODE=M070Q67;LINKAGE=A

$\Gamma(\overline{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{379}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.5 \times 10^{-8}$	90	¹ ABLIKIM	17AF BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S54
NODE=M070S54

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1.1 \times 10^{-5}$	90	ABLIKIM	06M BES2	$e^+ e^- \rightarrow J/\psi$
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¹ Using D^0 decays to $K^- \pi^+$, $K^- \pi^+ \pi^0$, and $K^- \pi^+ \pi^+ \pi^-$.

NODE=M070S54;LINKAGE=A

 $\Gamma(D_s^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{380}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-6}$	90	ABLIKIM	14R BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S55
NODE=M070S55

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<3.6 \times 10^{-5}$	90	¹ ABLIKIM	06M BES2	$e^+ e^- \rightarrow J/\psi$
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¹ Using $B(D_s^- \rightarrow \phi \pi^-) = 4.4 \pm 0.5 \%$.

NODE=M070S55;LINKAGE=AB

 $\Gamma(D_s^{*-} e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{381}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.8 \times 10^{-6}$	90	ABLIKIM	14R BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070B13
NODE=M070B13

 $\Gamma(D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{382}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.0 \times 10^{-8}$ (CL = 90%)				[$<7.5 \times 10^{-5}$ (CL = 90%) OUR 2024 BEST LIMIT]
$<7.0 \times 10^{-8}$	90	ABLIKIM	24BI BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S61
NODE=M070S61

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<7.5 \times 10^{-5}$	90	ABLIKIM	08J BES2	$e^+ e^- \rightarrow J/\psi$
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 $\Gamma(D^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{383}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.0 \times 10^{-7}$	90	ABLIKIM	24BI BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070Q63
NODE=M070Q63

 $\Gamma(\overline{D}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{384}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.7 \times 10^{-7}$	90	ABLIKIM	24BI BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070Q64
NODE=M070Q64

 $\Gamma(\overline{D}^0 \overline{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{385}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	ABLIKIM	08J BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S62
NODE=M070S62

 $\Gamma(\overline{D}^0 \overline{K}^{*0} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{386}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.5 \times 10^{-6}$	90	ABLIKIM	14K BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S93
NODE=M070S93

 $\Gamma(\overline{D}^0 \eta + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{387}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.8 \times 10^{-7}$	90	ABLIKIM	24BI BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070Q65
NODE=M070Q65

 $\Gamma(\overline{D}^0 \rho^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{388}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-7}$	90	ABLIKIM	24BI BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070Q66
NODE=M070Q66

 $\Gamma(D_s^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{389}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-4}$	90	ABLIKIM	08J BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S63
NODE=M070S63

 $\Gamma(D_s^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{390}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-5}$	90	ABLIKIM	14K BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S92
NODE=M070S92

———— CHARGE CONJUGATION (C), PARITY (P), ————
 ———— LEPTON FAMILY NUMBER (LF) VIOLATING MODES ————

NODE=M070315

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{391}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.7 \times 10^{-7}$	90	ABLIKIM	14Q BES3	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070R80
NODE=M070R80

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 0.5 \times 10^{-5}$	90	ADAMS	08	CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$< 1.6 \times 10^{-4}$	90	¹ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
$< 2.2 \times 10^{-5}$	90	ABLIKIM	07J	BES2	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
$< 50 \times 10^{-5}$	90	BARTEL	77	CNTR	$e^+ e^-$

¹ WICHT 08 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma \gamma) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] < 0.16 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.020 \times 10^{-3}$.

NODE=M070R80;LINKAGE=W1

$\Gamma(\gamma\phi) / \Gamma_{\text{total}}$ Γ_{392} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4 \times 10^{-6}$	90	ABLIKIM	14Q	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S95
NODE=M070S95

$\Gamma(e^\pm \mu^\mp) / \Gamma_{\text{total}}$ Γ_{393} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.6 \times 10^{-7}$	90	ABLIKIM	13L	BES3 $e^+ e^- \rightarrow J/\psi$

NODE=M070S39
NODE=M070S39

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 1.1 \times 10^{-6}$	90	BAI	03D	BES $e^+ e^- \rightarrow J/\psi$
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$\Gamma(e^\pm \tau^\mp) / \Gamma_{\text{total}}$ Γ_{394} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.5 \times 10^{-8}$	90	ABLIKIM	21M	BES3 $e^+ e^- \rightarrow J/\psi$

NODE=M070S40
NODE=M070S40

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 8.3 \times 10^{-6}$	90	¹ ABLIKIM	04	BES $e^+ e^- \rightarrow J/\psi$
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¹ Superseded by ABLIKIM 21M.

NODE=M070S40;LINKAGE=A

$\Gamma(\mu^\pm \tau^\mp) / \Gamma_{\text{total}}$ Γ_{395} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.0 \times 10^{-6}$	90	ABLIKIM	04	BES $e^+ e^- \rightarrow J/\psi$

NODE=M070S41
NODE=M070S41

$\Gamma(\Lambda_c^+ e^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{396} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.9 \times 10^{-8}$	90	ABLIKIM	19AF	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \rho K^- \pi^+ e^- (+ \text{c.c.})$

NODE=M070P74
NODE=M070P74

OTHER DECAYS

$\Gamma(\text{invisible}) / \Gamma(e^+ e^-)$ Γ_{397} / Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.6 \times 10^{-2}$	90	LEES	13I	BABR $B \rightarrow K^{(*)} J/\psi$

NODE=M070325

NODE=M070S80
NODE=M070S80

$\Gamma(\text{invisible}) / \Gamma(\mu^+ \mu^-)$ Γ_{397} / Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.2 \times 10^{-2}$	90	ABLIKIM	08G	BES2 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S60
NODE=M070S60

$\Gamma(\mu^+ \mu^- X^0 \rightarrow \mu^+ \mu^- + \text{invisible}) / \Gamma_{\text{total}}$ Γ_{398} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.5 \times 10^{-7}$	90	¹ ABLIKIM	24G	BES3 $J/\psi \rightarrow \mu^+ \mu^- X^0$ (scalar) $\rightarrow \mu^+ \mu^- + \text{invisible}$
$< 9.6 \times 10^{-7}$	90	² ABLIKIM	24G	BES3 $J/\psi \rightarrow \mu^+ \mu^- X^0$ (vector) $\rightarrow \mu^+ \mu^- + \text{invisible}$

NODE=M070Q69
NODE=M070Q69

OCCUR=2

¹ For a light scalar, X^0 , with a mass in the range 1–1000 MeV. The measured limit at the 90% credibility level as a function of m_{X^0} ranges from 6.2×10^{-9} to 5.5×10^{-7} .

NODE=M070Q69;LINKAGE=A

² For a light vector, X^0 , with a mass in the range 1–1000 MeV. The measured limit at the 90% credibility level as a function of m_{X^0} ranges from 4.5×10^{-9} to 9.6×10^{-7} .

NODE=M070Q69;LINKAGE=B

J/ ψ (1S) REFERENCES

NODE=M070

AAJ	24AE	JHEP 2412 062	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63039
ABLIKIM	24	PRL 132 181901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62645
ABLIKIM	24AB	PR D110 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62681
ABLIKIM	24AD	PR D110 L031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62683
ABLIKIM	24AM	JHEP 2401 126	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62697
ABLIKIM	24BI	PR D110 032020	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62938
ABLIKIM	24BQ	PR D110 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63020
ABLIKIM	24BZ	PR D110 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63031
ABLIKIM	24CB	PR D110 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63033
ABLIKIM	24G	PR D109 L031102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62657
ABLIKIM	24H	PR D109 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62658
ABLIKIM	24I	PR D109 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62659
ABLIKIM	24L	PR D109 052006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62662
HAYRAPETY...	24A	PR D109 L111101	A. Hayrapetyan <i>et al.</i>	(CMS Collab.)	REFID=62675
ABLIKIM	23BD	PR D108 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62425
ABLIKIM	23BU	PR D108 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62517
ABLIKIM	23E	PL B838 137698	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62047
ABLIKIM	23S	PR D107 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62063
ANASHIN	23	JHEP 2306 196	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=62057
GONG	23	PR D107 072008	G. Gong <i>et al.</i>	(BELLE Collab.)	REFID=62073
LEES	23	PR D107 072001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=62061
LIAO	23	PR D107 112007	L. Liao <i>et al.</i>		REFID=62279
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)	REFID=61911
ABLIKIM	22AI	PRL 129 192002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61881
Also		PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also		PR D107 079901 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
ABLIKIM	22AY	PR D106 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61902
ABLIKIM	22B	PRL 129 022002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61636
ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61637
ABLIKIM	22H	PR D105 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61643
ANASHIN	22	EPJ C82 938	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=61894
ABLIKIM	21AM	PR D104 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61445
ABLIKIM	21AT	JHEP 2111 226	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61463
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61030
ABLIKIM	21M	PR D103 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61118
ABLIKIM	21Q	JHEP 2106 157	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61125
LEES	21	PR D103 092001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61113
LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
LEES	21C	PR D104 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61451
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ABLIKIM	20	PR D101 012004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60048
ABLIKIM	20K	PR D101 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60316
ABLIKIM	20Q	EPJ C80 746	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60457
ANASHIN	20	JHEP 2007 112	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=60512
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19A	PR D99 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59517
Also		PR D104 099901 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61449
ABLIKIM	19AB	PR D99 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59846
ABLIKIM	19AC	PR D99 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59850
ABLIKIM	19AF	PR D99 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59857
ABLIKIM	19AN	PR D99 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59890
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
ABLIKIM	19H	PR D99 012013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59604
ABLIKIM	19N	PR D99 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59615
ABLIKIM	19Q	PL B791 375	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59747
ABLIKIM	19T	PRL 122 142002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59773
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)	REFID=59614
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ABLIKIM	18AB	PR D98 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59456
ABLIKIM	18D	PRL 121 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58849
ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58893
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58925
ANASHIN	18A	JHEP 1805 119	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=59102
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58900
LEES	18E	PR D98 112015	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=59505
ABLIKIM	17AF	PR D96 111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58315
ABLIKIM	17AH	PR D96 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58317
ABLIKIM	17AK	PR D96 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58324
ABLIKIM	17E	PL B770 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57903
ABLIKIM	17L	PR D95 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57967
LEES	17A	PR D95 052001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57966
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
LEES	17D	PR D95 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57990
ABLIKIM	16E	PR D93 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57265
ABLIKIM	16J	PRL 117 042002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57454
ABLIKIM	16K	PR D93 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57509
ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57510
ABLIKIM	16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57511
ABLIKIM	16N	PR D93 112011	M. Ablikim	(BESIII Collab.)	REFID=57512
ABLIKIM	16P	PR D94 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57522
ABLIKIM	16Q	PL B761 98	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57566
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
AAJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57147
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56773
ABLIKIM	15K	PR D91 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56776
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56785
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988
ABLIKIM	14I	PR D89 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55900
ABLIKIM	14K	PR D89 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55902
ABLIKIM	14N	PR D90 052009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55905
ABLIKIM	14Q	PR D90 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56238
ABLIKIM	14R	PR D90 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56388
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56130
AULCHENKO	14	PL B731 227	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=55655

LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54920
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54954
ABLIKIM	13J	PR D87 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54955
ABLIKIM	13L	PR D87 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55300
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
ABLIKIM	13P	PR D87 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55392
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55402
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55582
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
ABLIKIM	12	PR D85 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54265
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54267
ABLIKIM	12C	PR D86 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54268
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54269
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54273
ABLIKIM	12P	CP C36 1031	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=54863
LEES	12E	PR D85 112009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54297
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53646
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53684
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16715
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53349
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
ANASHIN	10	PL B685 134	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=53220
DEL-AMO-SA...	100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53533
INSLER	10	PR D81 091101	J. Insler <i>et al.</i>	(CLEO Collab.)	REFID=53359
ABLIKIM	09	PL B676 25	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52718
ABLIKIM	09B	PR D80 052004	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53099
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000
ABLIKIM	08	EPJ C53 15	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52047
ABLIKIM	08A	PR D77 012001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52128
ABLIKIM	08C	PL B659 789	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52130
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52154
ABLIKIM	08G	PRL 100 192001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52253
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52255
ABLIKIM	08J	PL B663 297	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52256
ABLIKIM	08O	PR D78 092005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52571
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
BESSION	08	PR D78 032012	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=52685
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABLIKIM	07H	PR D76 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52046
ABLIKIM	07J	PR D76 117101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52072
ANDREOTTI	07	PL B654 74	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (errat.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
ABLIKIM	06	PL B632 181	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50986
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06F	PR D73 052007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51058
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51128
ABLIKIM	06M	PL B639 418	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51130
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
ADAMS	06A	PR D73 051103	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51036
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05B	PR D71 032003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50496
ABLIKIM	05C	PL B610 192	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50507
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50985
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
LI	05C	PR D71 111103	Z. Li <i>et al.</i>	(CLEO Collab.)	REFID=50802
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer		REFID=51038
ABLIKIM	04	PL B598 172	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49739
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
AUBERT	04	PR D69 011103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49611
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
BAI	04A	PR D69 012003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49607
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04E	PL B591 42	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49751
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04H	PR D70 012005	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49754
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03D	PL B561 49	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49403

BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)	REFID=49473
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	00B	PL B472 200	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47427
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98G	PL B424 213	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46341
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BALDINI	98	PL B444 111	R. Baldini <i>et al.</i>	(FENICE Collab.)	REFID=46608
ARMSTRONG	96	PR D54 7067	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45146
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44736
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BAI	96D	PR D54 1221	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45198
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 and E706 Collab.)	REFID=44739
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REFID=45197
BAI	95B	PL B355 374	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44434
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ANTONELLI	93	PL B301 317	A. Antonelli <i>et al.</i>	(FENICE Collab.)	REFID=43314
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REFID=43601
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
COFFMAN	92	PRL 68 282	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41866
HSUEH	92	PR D45 2181	S. Hsueh, S. Palestini	(FNAL, TORI)	REFID=41899
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
BISELLO	90	PL B241 617	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41359
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
JOUSSET	90	PR D41 1389	J. Jousset <i>et al.</i>	(DM2 Collab.)	REFID=41349
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
COFFMAN	88	PR D38 2695	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=40346
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BAGLIN	87	NP B286 592	C. Baglin <i>et al.</i>	(LAPP, CERN, GENO, LYON+)	REFID=40002
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
HENNRARD	87	NP B292 670	P. Henrard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40261
PALLIN	87	NP B292 653	D. Pallin <i>et al.</i>	(CLER, FRAS, LALO, PADO)	REFID=40243
BALTRUSAIT...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)	REFID=21865
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=22101
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095
BALTRUSAIT...	85D	PR D32 566	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22097
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
		Translated from YAF 41 733.			
EATON	84	PR D29 804	M.W. Eaton <i>et al.</i>	(LBL, SLAC)	REFID=22092
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82B	PR D25 3065	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22080
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
Also		ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
BESCH	81	ZPHY C8 1	H.J. Besch <i>et al.</i>	(BONN, DESY, MAINZ)	REFID=22077
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
PARTRIDGE	80	PRL 44 712	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22073
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
		Translated from YAF 34 1471.			
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
ALEXANDER	78	PL 72B 493	G. Alexander <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22065
BESCH	78	PL 78B 347	H.J. Besch <i>et al.</i>	(BONN, DESY, MAINZ)	REFID=22066
BRANDELIK	78B	PL 74B 292	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22067
PERUZZI	78	PR D17 2901	I. Peruzzi <i>et al.</i>	(SLAC, LBL)	REFID=22068
BARTEL	77	PL 66B 489	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22058
BURMESTER	77D	PL 72B 135	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22060
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
VANNUCCI	77	PR D15 1814	F. Vannucci <i>et al.</i>	(SLAC, LBL)	REFID=22063
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
BRAUNSCH...	76	PL 63B 487	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22054
JEAN-MARIE	76	PRL 36 291	B. Jean-Marie <i>et al.</i>	(SLAC, LBL) IG	REFID=22056
BALDINI...	75	PL 58B 471	R. Baldini-Celio <i>et al.</i>	(FRAS, ROMA)	REFID=22026
BOYARSKI	75	PRL 34 1357	A.M. Boyarski <i>et al.</i>	(SLAC, LBL) JPC	REFID=22030
DASP	75	PL 56B 491	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22036
ESPOSITO	75B	LCN 14 73	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)	REFID=22038
FORD	75	PRL 34 604	R.L. Ford <i>et al.</i>	(SLAC, PENN)	REFID=22039

NODE=M870

BRANCHING RATIOS OF $\psi(2S)$, $\chi_{c0,1,2}$ AND η_c

Updated March 2024 by J.J. Hernández-Rey (IFIC, Valencia), R. Mitchell (Indiana U.), S. Navas (U. of Granada), and C. Patrignani (Bologna Univ., INFN)

Since 2002, the treatment of the branching ratios of the $\psi(2S)$ and $\chi_{c0,1,2}$ has undergone an important restructuring. Since the 2023 online edition, the $\eta_c(1S)$ is now treated in a similar way (see the end of this note).

When measuring a branching ratio experimentally, it is not always possible to normalize the number of events observed in the corresponding decay mode to the total number of particles produced. Therefore, the experimenters sometimes report the number of observed decays with respect to another decay mode of the same or another particle in the relevant decay chain. This is actually equivalent to measuring combinations of branching fractions of several decay modes.

To extract the branching ratio of a given decay mode, the collaborations use some previously reported measurements of the required branching ratios. However, the values are frequently taken from the *Review of Particle Physics* (RPP), which in turn uses the branching ratio reported by the experiment in the following edition, giving rise either to correlations or to plain vicious circles, as discussed in more detail in earlier editions of this review [1,2].

The way to avoid these dependencies and correlations is to extract the branching ratios through a fit that uses the truly measured combinations of branching fractions and partial widths. This fit, in fact, should involve decays from the four concerned particles, $\psi(2S)$, χ_{c0} , χ_{c1} , and χ_{c2} , and occasionally some combinations of branching ratios of more than one of them. This is what is done since the 2002 edition [3].

The PDG policy is to quote the results of the collaborations in a manner as close as possible to what appears in their original publications. However, in order to avoid the problems mentioned above, we had in some cases to work out the values originally measured, using the number of events and detection efficiencies given by the collaborations, or rescaling back the published results. The information was sometimes spread over several articles, and some articles referred to papers still unpublished, which in turn contained the relevant numbers in footnotes.

Even though the experimental collaborations are entitled to extract whatever branching ratios they consider appropriate by

using other published results, we would like to encourage them to also quote explicitly in their articles the actual quantities measured, so that they can be used directly in averages and fits of different experimental determinations.

To inform the reader how we computed some of the values used in this edition of RPP, we use footnotes to indicate the branching ratios actually given by the experiments and the quantities they use to derive them from the true combination of branching ratios actually measured.

None of the branching ratios of the $\chi_{c0,1,2}$ are measured independently of the $\psi(2S)$ radiative decays. We tried to identify those branching ratios which can be correlated in a non-trivial way, and although we cannot preclude the existence of other cases, we are confident that the most relevant correlations have already been removed. Nevertheless, correlations in the errors of different quantities measured by the same experiment have not been taken into account.

The $\eta_c(1S)$ can be produced in $\gamma\gamma$ collisions, in the radiative decays of vector and axial-vector charmonia (J/ψ , $\psi(2S)$ and $h_c(1P)$) or in B meson decays. As for the $\psi(2S)$ and $\chi_{c0,1,2}$, correlations can be introduced if the derived branching ratios are not properly extracted. We now obtain the corresponding branching ratios using the products of branching ratios originally measured by the experiments, sometimes among different particles (cross-particle branching ratios) and performing an overall fit. In some cases, we were obliged to infer the original product from the information given by the collaborations. However, for recent experiments our policy is not to use anymore extracted branching ratios, so that if the original measured quantity is missing in the relevant publication, the value will not be used in our averages and fits.

1. Fit Information for the $\psi(2S)$ and $\chi_{c0,1,2}$

This is an overall fit to 4 total widths, 1 partial width, 25 combinations of partial widths, 10 branching fractions, and 76 branching ratios or combinations thereof. Of the latter, 58 involve decays of more than one particle.

The overall fit uses 253 measurements to determine 49 parameters and gives a χ^2 of 389.6 for 204 degrees of freedom. We have applied scaling factors in the final errors of the fitted values following the procedure described in section 5.2.3 of our Introduction. After rescaling, the total χ^2 is 149.6.

In the listing we provide the inter-particle correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the corresponding parameter x_i .

2. Fit Information for the $\eta_c(1S)$

This is an overall fit to 1 total width, 10 combinations of partial widths, 6 branching fractions and 32 branching ratios or combinations thereof. Of the latter, 31 involve decays of more than one particle.

The overall fit uses 113 measurements to determine 19 parameters and has a χ^2 of 184.6 for 94 degrees of freedom. We have applied scaling factors in the final errors of the fitted values following the procedure described in section 5.2.3 of our Introduction. After rescaling, the total χ^2 is 74.1.

In the listing we provide the inter-particle correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the corresponding parameter x_i .

References

1. Y.F. Gu and X.H. Li, Phys. Lett. **B449**, 361 (1999).
2. C. Patrignani, Phys. Rev. **D64**, 034017 (2001).
3. K. Hagiwara *et al.* (Particle Data Group), Phys. Rev. **D68**, 010001 (2002).

$\chi_{c0}(1P)$

$I^G(J^{PC}) = 0^+(0^{++})$

NODE=M056

$\chi_{c0}(1P)$ MASS

NODE=M056M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3414.71 ± 0.30 OUR AVERAGE				
3413.0 ± 1.9 ± 0.6	933	¹ AAIJ	17BB LHCB	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3414.2 ± 0.5 ± 2.3	5.4k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
3406 ± 7 ± 6	230	² ABE	07 BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$
3414.21 ± 0.39 ± 0.27		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$
3414.7 ⁺ 0.7 _{-0.6} ± 0.2		³ ANDREOTTI	03 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
3415.5 ± 0.4 ± 0.4	392	⁴ BAGNASCO	02 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
3417.4 ⁺ 1.8 _{-1.9} ± 0.2		³ AMBROGIANI	99B E835	$\bar{p}p \rightarrow e^+e^-\gamma$
3414.1 ± 0.6 ± 0.8		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3417.8 ± 0.4 ± 4		³ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3416 ± 3 ± 4		⁵ TANENBAUM	78 MRK1	e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3414.6 ± 1.1	266	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3416.5 ± 3.0		EISENSTEIN	01 CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c0}$
3422 ± 10		⁵ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3415 ± 9		⁵ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$

NODE=M056M

- ¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c0}(1P)$ fixed to the PDG 16 value.
² From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
³ Using mass of $\psi(2S) = 3686.0$ MeV.
⁴ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.
⁵ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

NODE=M056M;LINKAGE=A

NODE=M056M;LINKAGE=EB

NODE=M056M;LINKAGE=C

NODE=M056M;LINKAGE=NW

NODE=M056M;LINKAGE=D

 $\chi_{c0}(1P)$ WIDTH

NODE=M056W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.9±0.6 OUR FIT	Error includes scale factor of 1.1. [10.7 ± 0.6 MeV OUR 2024 FIT Scale factor = 1.1]			
10.5±0.8 OUR AVERAGE	Error includes scale factor of 1.1.			
10.6±1.9±2.6	5.4k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow$ hadrons
12.6 ^{+1.5+0.9} _{-1.6-1.1}		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$
8.6 ^{+1.7} _{-1.3} ±0.1		ANDREOTTI	03 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
9.7±1.0	392	¹ BAGNASCO	02 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
16.6 ^{+5.2} _{-3.7} ±0.1		AMBROGIANI	99B E835	$\bar{p}p \rightarrow e^+e^-\gamma$
14.3±2.0±3.0		BAI	98I BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
13.5±3.3±4.2		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X, \gamma\pi^0\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
13.2±2.1	266	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M056W

NEW

¹ Recalculated by ANDREOTTI 05A.

NODE=M056W;LINKAGE=AN

 $\chi_{c0}(1P)$ DECAY MODES

NODE=M056215;NODE=M056

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(2.18±0.11) %	S=1.2
Γ_2 $\rho^0\pi^+\pi^-$	(8.5 ± 2.7) × 10 ⁻³	
Γ_3 $\rho^0\rho^0$		
Γ_4 $f_0(980)f_0(980)$	(6.7 ± 2.1) × 10 ⁻⁴	
Γ_5 $\pi^+\pi^-\pi^0\pi^0$	(3.3 ± 0.4) %	
Γ_6 $\rho^+\pi^-\pi^0 + c.c.$	(2.9 ± 0.4) %	
Γ_7 $4\pi^0$	(3.3 ± 0.4) × 10 ⁻³	
Γ_8 $\pi^+\pi^-K^+K^-$	(1.81±0.16) %	S=1.2
Γ_9 $K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	(9.9 ^{+4.0} _{-2.8}) × 10 ⁻⁴	
Γ_{10} $K_0^*(1430)^0\bar{K}_2^*(1430)^0 + c.c. \rightarrow \pi^+\pi^-K^+K^-$	(8.0 ^{+2.0} _{-2.4}) × 10 ⁻⁴	
Γ_{11} $K_1(1270)^+K^- + c.c. \rightarrow \pi^+\pi^-K^+K^-$	(6.3 ± 1.9) × 10 ⁻³	
Γ_{12} $K_1(1400)^+K^- + c.c. \rightarrow \pi^+\pi^-K^+K^-$	< 2.7 × 10 ⁻³	CL=90%
Γ_{13} $f_0(980)f_0(980)$	(1.6 ^{+1.0} _{-0.9}) × 10 ⁻⁴	
Γ_{14} $f_0(980)f_0(2200)$	(8.0 ^{+2.0} _{-2.5}) × 10 ⁻⁴	
Γ_{15} $f_0(1370)f_0(1370)$	< 2.7 × 10 ⁻⁴	CL=90%
Γ_{16} $f_0(1370)f_0(1500)$	< 1.7 × 10 ⁻⁴	CL=90%
Γ_{17} $f_0(1370)f_0(1710)$	(6.7 ^{+3.5} _{-2.3}) × 10 ⁻⁴	
Γ_{18} $f_0(1500)f_0(1370)$	< 1.3 × 10 ⁻⁴	CL=90%
Γ_{19} $f_0(1500)f_0(1500)$	< 5 × 10 ⁻⁵	CL=90%
Γ_{20} $f_0(1500)f_0(1710)$	< 7 × 10 ⁻⁵	CL=90%
Γ_{21} $K^+K^-\pi^+\pi^-\pi^0$	(8.6 ± 0.9) × 10 ⁻³	
Γ_{22} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(4.2 ± 0.4) × 10 ⁻³	
Γ_{23} $K^+K^-\pi^0\pi^0$	(5.6 ± 0.9) × 10 ⁻³	
Γ_{24} $K^+\pi^-\bar{K}^0\pi^0 + c.c.$	(2.50±0.33) %	
Γ_{25} $\rho^+K^-K^0 + c.c.$	(1.21±0.21) %	

NODE=M056;CLUMP=A

DESIG=3

DESIG=9

DESIG=54

DESIG=20

DESIG=61

DESIG=62

DESIG=70

DESIG=5

DESIG=31

DESIG=32

DESIG=33

DESIG=34

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DESIG=24

DESIG=25

DESIG=26

DESIG=27

DESIG=28

DESIG=29

DESIG=30

DESIG=75

DESIG=87

DESIG=63

DESIG=65

DESIG=66

Γ ₂₆	$K^*(892)^- K^+ \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(4.6 \pm 1.2) \times 10^{-3}$		DESIG=67
Γ ₂₇	$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		DESIG=41
Γ ₂₈	$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Γ ₂₉	$3(\pi^+ \pi^-)$	$(1.96 \pm 0.22) \%$	S=3.4	DESIG=4
Γ ₃₀	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.4 \pm 1.6) \times 10^{-3}$		DESIG=10
Γ ₃₁	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Γ ₃₂	$\pi \pi$	$(8.6 \pm 0.4) \times 10^{-3}$	S=1.2	DESIG=18
Γ ₃₃	$\pi^0 \eta$	$< 1.8 \times 10^{-4}$		DESIG=35
Γ ₃₄	$\pi^0 \eta'$	$< 1.1 \times 10^{-3}$		DESIG=36
Γ ₃₅	$\pi^0 \eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	DESIG=86
Γ ₃₆	$\eta \eta$	$(3.02 \pm 0.25) \times 10^{-3}$	S=1.3	DESIG=13
Γ ₃₇	$\eta \eta'$	$(9.1 \pm 1.1) \times 10^{-5}$		DESIG=37
Γ ₃₈	$\eta' \eta'$	$(2.18 \pm 0.12) \times 10^{-3}$		DESIG=46
Γ ₃₉	$\omega \omega$	$(9.7 \pm 1.1) \times 10^{-4}$		DESIG=22
Γ ₄₀	$\omega \phi$	$(1.42 \pm 0.13) \times 10^{-4}$		DESIG=76
Γ ₄₁	$\omega K^+ K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		DESIG=88
Γ ₄₂	$K^+ K^-$	$(6.07 \pm 0.33) \times 10^{-3}$	S=1.1	DESIG=2
Γ ₄₃	$K_S^0 K_S^0$	$(3.18 \pm 0.19) \times 10^{-3}$	S=1.1	DESIG=15
Γ ₄₄	$\pi^+ \pi^- \eta$	$< 2.0 \times 10^{-4}$	CL=90%	DESIG=50
Γ ₄₅	$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=53
Γ ₄₆	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Γ ₄₇	$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Γ ₄₈	$K^+ K^- \eta$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=51
Γ ₄₉	$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Γ ₅₀	$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		DESIG=94
Γ ₅₁	$K^+ K^- K^+ K^-$	$(2.8 \pm 0.4) \times 10^{-3}$	S=1.5	DESIG=14
Γ ₅₂	$K^+ K^- \phi$	$(9.7 \pm 2.5) \times 10^{-4}$		DESIG=44
Γ ₅₃	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		DESIG=91
Γ ₅₄	$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		DESIG=92
Γ ₅₅	$3(K^+ K^-)$	$(1.08 \pm 0.22) \times 10^{-5}$		DESIG=106
Γ ₅₆	$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		DESIG=89
Γ ₅₇	$\phi \phi$	$(8.48 \pm 0.31) \times 10^{-4}$		DESIG=16
Γ ₅₈	$\phi \phi \eta$	$(8.4 \pm 1.0) \times 10^{-4}$		DESIG=96
Γ ₅₉	$\rho \bar{\rho}$	$(2.21 \pm 0.14) \times 10^{-4}$	S=1.6	DESIG=11
Γ ₆₀	$\rho \bar{\rho} \pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.3	DESIG=48
Γ ₆₁	$\rho \bar{\rho} \eta$	$(3.6 \pm 0.4) \times 10^{-4}$		DESIG=52
Γ ₆₂	$\rho \bar{\rho} \omega$	$(5.3 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ ₆₃	$\rho \bar{\rho} \phi$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=74
Γ ₆₄	$\rho \bar{\rho} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8
Γ ₆₅	$\rho \bar{\rho} \pi^0 \pi^0$	$(1.04 \pm 0.28) \times 10^{-3}$		DESIG=64
Γ ₆₆	$\rho \bar{\rho} K^+ K^- (\text{non-resonant})$	$(1.22 \pm 0.26) \times 10^{-4}$		DESIG=71
Γ ₆₇	$\rho \bar{\rho} K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Γ ₆₈	$\rho \bar{\rho} K_S^0 K^- \pi^+ + \text{c.c.}$	$(2.6 \pm 0.4) \times 10^{-5}$		DESIG=107
Γ ₆₉	$\rho \bar{n} \pi^-$	$(1.27 \pm 0.11) \times 10^{-3}$		DESIG=43
Γ ₇₀	$\bar{\rho} n \pi^+$	$(1.37 \pm 0.12) \times 10^{-3}$		DESIG=82
Γ ₇₁	$\rho \bar{n} \pi^- \pi^0$	$(2.35 \pm 0.21) \times 10^{-3}$		DESIG=83
Γ ₇₂	$\bar{\rho} n \pi^+ \pi^0$	$(2.22 \pm 0.19) \times 10^{-3}$		DESIG=84
Γ ₇₃	$\Lambda \bar{\Lambda}$	$(3.61 \pm 0.16) \times 10^{-4}$	S=1.1	DESIG=19
Γ ₇₄	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.18 \pm 0.13) \times 10^{-3}$		DESIG=38
Γ ₇₅	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$< 5 \times 10^{-4}$	CL=90%	DESIG=77
Γ ₇₆	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=78
Γ ₇₇	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=79
Γ ₇₈	$\Lambda \bar{\Lambda} \eta$	$(2.3 \pm 0.4) \times 10^{-4}$		DESIG=102
Γ ₇₉	$\Lambda \bar{\Lambda} \omega$	$(2.38 \pm 0.34) \times 10^{-4}$		DESIG=105
Γ ₈₀	$\Lambda \bar{\Lambda} \phi$	$(3.0 \pm 1.3) \times 10^{-5}$		DESIG=104
Γ ₈₁	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(1.25 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Γ ₈₂	$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(6.7 \pm 0.5) \times 10^{-4}$		DESIG=101
Γ ₈₃	$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.8 \pm 0.9) \times 10^{-4}$		DESIG=98

Γ ₈₄	$K^+ \bar{p} \Lambda(1520) + c.c.$	$(3.0 \pm 0.8) \times 10^{-4}$		DESIG=72
Γ ₈₅	$\bar{p} \Lambda(1520) K_S^0 \pi^+ + c.c.$	$(1.6 \pm 0.7) \times 10^{-5}$		DESIG=108
Γ ₈₆	$\Lambda(1520) \bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Γ ₈₇	$\Sigma^0 \bar{\Sigma}^0$	$(4.70 \pm 0.32) \times 10^{-4}$		DESIG=58
Γ ₈₈	$\Sigma^+ \bar{p} K_S^0 + c.c.$	$(3.54 \pm 0.27) \times 10^{-4}$		DESIG=97
Γ ₈₉	$\Sigma^0 \bar{p} K^+ + c.c.$	$(3.05 \pm 0.20) \times 10^{-4}$		DESIG=100
Γ ₉₀	$\Sigma^+ \bar{\Sigma}^-$	$(4.7 \pm 0.8) \times 10^{-4}$	S=2.6	DESIG=59
Γ ₉₁	$\Sigma^+ \bar{\Sigma}^- \eta$	$(1.27 \pm 0.24) \times 10^{-4}$		DESIG=109
Γ ₉₂	$\Sigma^- \bar{\Sigma}^+$	$(5.2 \pm 0.5) \times 10^{-4}$		DESIG=99
Γ ₉₃	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		DESIG=80
Γ ₉₄	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(2.3 \pm 0.7) \times 10^{-4}$		DESIG=81
Γ ₉₅	$K^- \bar{\Lambda} \bar{\Xi}^+ + c.c.$	$(1.95 \pm 0.35) \times 10^{-4}$		DESIG=85
Γ ₉₆	$\Xi^0 \bar{\Xi}^0$	$(4.5 \pm 0.5) \times 10^{-4}$	S=1.7	DESIG=60
Γ ₉₇	$\Xi^- \bar{\Xi}^+$	$(4.48 \pm 0.20) \times 10^{-4}$		DESIG=39
Γ ₉₈	$\Omega^- \bar{\Omega}^+$	$(3.5 \pm 0.6) \times 10^{-5}$		DESIG=103
Γ ₉₉	$\eta_c \pi^+ \pi^-$	$< 7 \times 10^{-4}$	CL=90%	DESIG=90
Radiative decays				
Γ ₁₀₀	$\gamma J/\psi(1S)$	$(1.41 \pm 0.09) \%$	S=1.7	NODE=M056;CLUMP=B DESIG=6
Γ ₁₀₁	$\gamma \rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Γ ₁₀₂	$\gamma \omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Γ ₁₀₃	$\gamma \phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Γ ₁₀₄	$\gamma \gamma$	$(2.06 \pm 0.10) \times 10^{-4}$	S=1.1	DESIG=7
Γ ₁₀₅	$e^+ e^- J/\psi(1S)$	$(1.34 \pm 0.30) \times 10^{-4}$		DESIG=93
Γ ₁₀₆	$\mu^+ \mu^- J/\psi(1S)$	$< 1.9 \times 10^{-5}$	CL=90%	DESIG=95

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 88 branching ratios uses 255 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 393.1$ for 206 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x ₂	15									
x ₈	10	1								
x ₃₀	4	1	33							
x ₃₂	21	3	9	3						
x ₃₆	13	2	5	1	13					
x ₄₂	19	3	8	3	20	12				
x ₄₃	19	3	8	3	19	11	17			
x ₅₁	7	1	5	3	6	3	6	5		
x ₅₇	5	1	3	1	4	3	4	4	2	
x ₅₉	6	1	2	1	0	1	5	5	2	1
x ₇₃	24	4	9	3	24	15	22	21	6	5
x ₁₀₀	6	1	2	1	8	5	6	5	1	1
x ₁₀₄	11	2	-4	-4	14	9	11	12	-1	1
Γ	-19	-3	-21	-11	-16	-8	-16	-14	-12	-7
	x ₁	x ₂	x ₈	x ₃₀	x ₃₂	x ₃₆	x ₄₂	x ₄₃	x ₅₁	x ₅₇
x ₇₃	7									
x ₁₀₀	-37	7								
x ₁₀₄	3	17	8							
Γ	-3	-15	-5	-43						
	x ₅₉	x ₇₃	x ₁₀₀	x ₁₀₄						

$\chi_{c0}(1P)$ PARTIAL WIDTHS $\chi_{c0}(1P) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ $\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
48.7 ± 3.5 OUR FIT					Error includes scale factor of 1.2. [51 ± 8 eV OUR 2024 FIT Scale factor = 1.9]

49 ± 10 OUR AVERAGE Error includes scale factor of 1.8.

44.7 ± 3.6 ± 4.9	3.6k	UEHARA	08	BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$
75 ± 13 ± 8		EISENSTEIN	01	CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c0}$

NODE=M056217

NODE=M056224

NODE=M056G2

NODE=M056G2

NEW

 $\Gamma(\rho^0\rho^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<12	90	<252	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$
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NODE=M056G07

NODE=M056G07

 $\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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41 ± 4 OUR FIT Error includes scale factor of 1.1. [40 ± 4 eV OUR 2024 FIT Scale factor = 1.1]

38.8 ± 3.7 ± 4.7 1.7k UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

NODE=M056G08

NODE=M056G08

NEW

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{21}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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26 ± 4 ± 4 1094 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M056G01

NODE=M056G01

 $\Gamma(K^+\bar{K}^*(892)^0\pi^-\pi^0 + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{30}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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17 ± 4 OUR FIT
[16 ± 4 eV OUR 2024 FIT]

16.7 ± 6.1 ± 3.0 495 ± 182 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

NODE=M056G09

NODE=M056G09

NEW

 $\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{31}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	<148	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$
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NODE=M056G10

NODE=M056G10

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{32}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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19.1 ± 1.5 OUR FIT Error includes scale factor of 1.2. [18.7 ± 1.5 eV OUR 2024 FIT Scale factor = 1.2]

23 ± 5 OUR AVERAGE

29.7 ^{+17.4} _{-12.0} ± 4.8	103 ⁺⁶⁰ ₋₄₂	¹ UEHARA	09	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
22.7 ± 3.2 ± 3.5	129 ± 18	² NAKAZAWA	05	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$

¹We multiplied the measurement by 3 to convert from $\pi^0\pi^0$ to $\pi\pi$. Interference with the continuum included.

²We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056G3

NODE=M056G3

NEW

NODE=M056G3;LINKAGE=UE

NODE=M056G;LINKAGE=NA

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{36}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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9.4 ± 2.3 ± 1.2 22 ¹UEHARA 10A BELL 10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$

¹Interference with the continuum not included.

NODE=M056G06

NODE=M056G06

NODE=M056G06;LINKAGE=UE

 $\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{39}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.9	90	¹ LIU	12B	BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$
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¹Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G02

NODE=M056G02

NODE=M056G02;LINKAGE=LI

 $\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{40}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.34	90	¹ LIU	12B	BELL	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
-------	----	------------------	-----	------	--

¹Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G03

NODE=M056G03

NODE=M056G03;LINKAGE=LI

$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{42}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
13.6±1.1 OUR FIT				Error includes scale factor of 1.1. [13.3 ± 1.1 eV OUR 2024 FIT Scale factor = 1.1]
14.3±1.6±2.3	153 ± 17	NAKAZAWA 05	BELL	10.6 e ⁺ e ⁻ → e ⁺ e ⁻ K ⁺ K ⁻

NODE=M056G4
 NODE=M056G4
 NEW

 $\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{43}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.1 ±0.6 OUR FIT				Error includes scale factor of 1.1. [7.0 ± 0.6 eV OUR 2024 FIT Scale factor = 1.2]
8.7 ±1.7 ±0.9	266	¹ UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.00±0.65±0.71	134 ± 12	CHEN	07B BELL	e ⁺ e ⁻ → e ⁺ e ⁻ χ _{c0}
¹ Supersedes CHEN 07B.				

NODE=M056G5
 NODE=M056G5
 NEW

NODE=M056G5;LINKAGE=UE

 $\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{51}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±1.0 OUR FIT				Error includes scale factor of 1.4. [6.2 ± 1.0 eV OUR 2024 FIT Scale factor = 1.5]
7.9±1.3±1.1	215 ± 36	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+K^-)$

NODE=M056G11
 NODE=M056G11
 NEW

 $\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{57}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.89±0.13 OUR FIT				Error includes scale factor of 1.1. [1.86 ± 0.13 eV OUR 2024 FIT Scale factor = 1.1]
1.72±0.33±0.14	56 ± 11	¹ LIU	12B BELL	$\gamma\gamma \rightarrow 2(K^+K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.3 ±0.9 ±0.4	23.6 ±9.6	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+K^-)$
¹ Supersedes UEHARA 08. Using B(φ → K ⁺ K ⁻) = (48.9 ± 0.5)%.				

NODE=M056G12
 NODE=M056G12
 NEW

NODE=M056G12;LINKAGE=LI

 $\chi_{c0}(1P)$ BRANCHING RATIOS

NODE=M056220

HADRONIC DECAYS

NODE=M056305

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.39±0.12 OUR FIT			
0.39±0.12	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R54
 NODE=M056R54

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.14±0.09±0.05	1946	¹ ABLIKIM	24BT BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M056P08
 NODE=M056P08

NODE=M056P08;LINKAGE=A

¹ABLIKIM 24BT reports $2.127 \pm 0.002 \pm 0.101$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±2.1±0.2	36 ± 9	¹ ABLIKIM	04G BES	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$
¹ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(6.5 \pm 1.6 \pm 1.3) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R24
 NODE=M056R24

NODE=M056R24;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.4±0.1	1751.4	¹ HE	08B CLEO	e ⁺ e ⁻ → γh ⁺ h ⁻ h ⁰ h ⁰
¹ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R62
 NODE=M056R62

NODE=M056R62;LINKAGE=HE

$$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.4±0.1	1358.5	1,2 HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R63
NODE=M056R63

¹ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R63;LINKAGE=HE

² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M056R63;LINKAGE=OC

$$\Gamma(4\pi^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.4±0.1	3296	¹ ABLIKIM	11A BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R71
NODE=M056R71

¹ ABLIKIM 11A reports $(3.34 \pm 0.06 \pm 0.44) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R71;LINKAGE=AB

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(\pi^+ \pi^- K^+ K^-) \quad \Gamma_{30}/\Gamma_8$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.41±0.09 OUR FIT 0.41±0.10	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R55
NODE=M056R55

$$\Gamma(K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.9^{+3.6}_{-2.8}±0.2	83	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R36
NODE=M056R36

¹ ABLIKIM 05Q reports $(10.44 \pm 2.37^{+3.05}_{-1.90}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R36;LINKAGE=AB

$$\Gamma(K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.0^{+2.0}_{-2.4}±0.2	62	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R37
NODE=M056R37

¹ ABLIKIM 05Q reports $(8.49 \pm 1.66^{+1.32}_{-1.99}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R37;LINKAGE=AB

$$\Gamma(K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±1.9±0.1	68	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R38
NODE=M056R38

¹ ABLIKIM 05Q reports $(6.66 \pm 1.31^{+1.60}_{-1.51}) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The measurement assumes $B(K_1(1270) \rightarrow K \rho(770)) = 42 \pm 6\%$.

NODE=M056R38;LINKAGE=AB

$$\Gamma(K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R39
NODE=M056R39

¹ ABLIKIM 05Q reports $< 2.85 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. The measurement assumes $B(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

NODE=M056R39;LINKAGE=AB

$\Gamma(f_0(980) f_0(980))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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$16.3^{+10.5}_{-9.0} \pm 0.4$	28	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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NODE=M056R28
NODE=M056R28

¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.59 \pm 0.50^{+0.89}_{-0.72}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. One of the $f_0(980)$ mesons is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay.

NODE=M056R28;LINKAGE=AB

 $\Gamma(f_0(980) f_0(2200))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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$8.0^{+2.0}_{-2.5}$ OUR AVERAGE				$[(7.9^{+2.0}_{-2.5}) \times 10^{-4}$ OUR 2024 AVERAGE]
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NODE=M056R29
NODE=M056R29

NEW

$8.0^{+2.0}_{-2.5} \pm 0.2$	77	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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¹ ABLIKIM 05Q reports $(8.42 \pm 1.42^{+1.65}_{-2.29}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(2200))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(980) \rightarrow \pi^+ \pi^-$ and $f_0(2200) \rightarrow K^+ K^-$ decays.

NODE=M056R29;LINKAGE=AB

 $\Gamma(f_0(1370) f_0(1370))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<2.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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¹ ABLIKIM 05Q reports $< 2.9 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370) f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. One of the $f_0(1370)$ mesons is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R30
NODE=M056R30

NODE=M056R30;LINKAGE=AB

 $\Gamma(f_0(1370) f_0(1500))/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<1.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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¹ ABLIKIM 05Q reports $< 1.8 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370) f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+ \pi^-$ and $f_0(1500) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R31
NODE=M056R31

NODE=M056R31;LINKAGE=AB

 $\Gamma(f_0(1370) f_0(1710))/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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$6.7^{+3.5}_{-2.3} \pm 0.2$	61	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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¹ ABLIKIM 05Q reports $(7.12 \pm 1.85^{+3.28}_{-1.68}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370) f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R32
NODE=M056R32

NODE=M056R32;LINKAGE=AB

 $\Gamma(f_0(1500) f_0(1370))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<1.3	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
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¹ ABLIKIM 05Q reports $< 1.4 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1370) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R33
NODE=M056R33

NODE=M056R33;LINKAGE=AB

$\Gamma(f_0(1500) f_0(1500))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	¹ ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
¹ ABLIKIM 05Q reports $< 0.55 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. One of the $f_0(1500)$ is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R34
NODE=M056R34

NODE=M056R34;LINKAGE=AB

 $\Gamma(f_0(1500) f_0(1710))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	¹ ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
¹ ABLIKIM 05Q reports $< 0.73 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R35
NODE=M056R35

NODE=M056R35;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.61±0.13±0.94	9.0k	¹ ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.				

NODE=M056R85
NODE=M056R85

NODE=M056R85;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.22±0.10±0.43	2.7k	¹ ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.				

NODE=M056R86
NODE=M056R86

NODE=M056R86;LINKAGE=A

 $\Gamma(K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.56±0.09±0.01	213.5	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $0.59 \pm 0.05 \pm 0.08 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R64
NODE=M056R64

NODE=M056R64;LINKAGE=HE

 $\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.50±0.33 OUR AVERAGE				[(2.49 ± 0.33)% OUR 2024 AVERAGE]
2.50±0.33±0.06	401.7	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R66
NODE=M056R66

NEW

NODE=M056R66;LINKAGE=HE

 $\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.21±0.21±0.03	179.7	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $1.28 \pm 0.16 \pm 0.15 \pm 0.07$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R67
NODE=M056R67

NODE=M056R67;LINKAGE=HE

$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ **Γ_{26}/Γ**

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.46±0.12±0.01	64.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R68
NODE=M056R68

NODE=M056R68;LINKAGE=HE

¹ HE 08B reports $0.49 \pm 0.10 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ **Γ_{27}/Γ**

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7±1.1±0.1	152 ± 14	¹ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R47
NODE=M056R47

NODE=M056R47;LINKAGE=AB

¹ ABLIKIM 05o reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (0.558 \pm 0.051 \pm 0.089) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}$ **Γ_{28}/Γ**

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.07±0.01	56.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R69
NODE=M056R69

NODE=M056R69;LINKAGE=HE

¹ HE 08B reports $0.32 \pm 0.05 \pm 0.05 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ **Γ_{29}/Γ**

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
19.6±2.2 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below. [(19.5 ± 2.2) × 10 ⁻³ OUR 2024 AVERAGE Scale factor = 3.3]		
20.9±0.5±0.5	145K	¹ ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
11.7±1.0±1.9		² BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
12.5±2.9±0.5		² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R4
NODE=M056R4

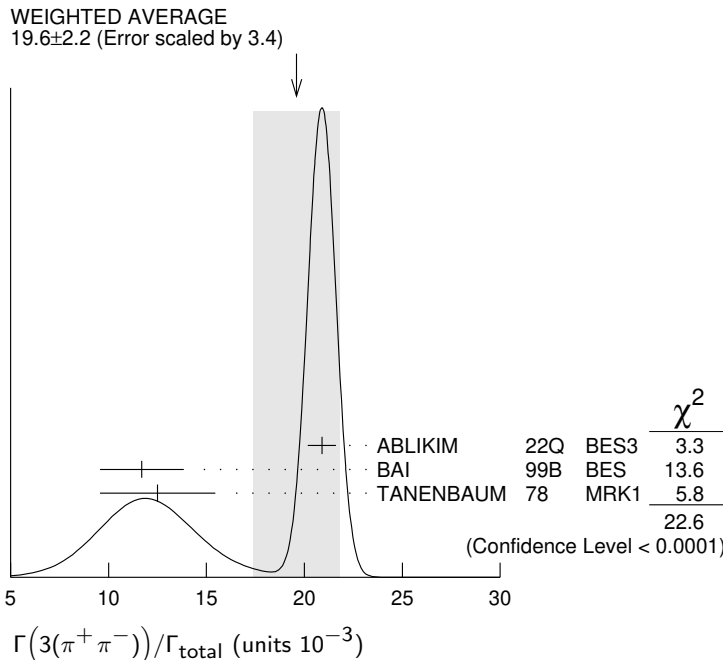
NEW

¹ ABLIKIM 22Q reports $(2.080 \pm 0.006 \pm 0.068) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R4;LINKAGE=A

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R;LINKAGE=X1



$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.72^{+0.60}_{-0.55} \pm 0.04$	64	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R26
 NODE=M056R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.57 \pm 0.40 \pm 0.04$ 30 \pm 6 ^{2,3} ABLIKIM 04H BES Repl. by ABLIKIM 05Q

¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.168 \pm 0.035^{+0.047}_{-0.040}) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26;LINKAGE=AI

² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

NODE=M056R;LINKAGE=AL

³ ABLIKIM 04H reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(1.53 \pm 0.29 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26;LINKAGE=AB

 $\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.6 \times 10^{-3}$	90	¹ ABLIKIM	15N BES3	$\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$

NODE=M056R00
 NODE=M056R00

¹ Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.

NODE=M056R00;LINKAGE=A

 $\Gamma(\eta \eta')/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$9.1 \pm 1.1 \pm 0.2$		85	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta$

NODE=M056R03
 NODE=M056R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 24 90 35 \pm 13 ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \eta' \eta$

< 50 90 ³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ ABLIKIM 17AI reports $(8.92 \pm 0.84 \pm 0.65) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R03;LINKAGE=A

² ASNER 09 reports $< 0.25 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AS

³ Superseded by ASNER 09. ADAMS 07 reports $< 0.5 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R03;LINKAGE=AD

 $\Gamma(\eta' \eta')/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.18 ± 0.12 OUR AVERAGE				

NODE=M056R04
 NODE=M056R04

$[(2.17 \pm 0.12) \times 10^{-3}]$ OUR 2024 AVERAGE]

NEW

$2.24 \pm 0.13 \pm 0.05$ 2.5k ¹ ABLIKIM 17AI BES3 $\psi(2S) \rightarrow \gamma \eta' \eta'$

$2.01 \pm 0.21 \pm 0.05$ 0.4k ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \eta' \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.61 \pm 0.41 \pm 0.04$ 23 ³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ ABLIKIM 17AI reports $(2.19 \pm 0.03 \pm 0.14) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=A

² ASNER 09 reports $(2.12 \pm 0.13 \pm 0.21) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AS

³ Superseded by ASNER 09. ADAMS 07 reports $(1.7 \pm 0.4 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 0.0922 \pm 0.0011 \pm 0.0046$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04;LINKAGE=AD

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{39}/Γ
0.97±0.11 OUR AVERAGE					
0.94±0.11±0.02	991	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons	
2.18±0.66±0.05	38.1±9.6	² ABLIKIM	05N BES2	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma6\pi$	

NODE=M056R27
NODE=M056R27

¹ ABLIKIM 11K reports $(0.95 \pm 0.03 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AL

² ABLIKIM 05N reports $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (0.212 \pm 0.053 \pm 0.037) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27;LINKAGE=AB

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{40}/Γ
1.42±0.13±0.03	486	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.18±0.22±0.03	76	^{2,3} ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons	

NODE=M056R76
NODE=M056R76

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (13.83 \pm 0.70 \pm 1.01) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R76;LINKAGE=A

² ABLIKIM 11K reports $(1.2 \pm 0.1 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R76;LINKAGE=AL

³ Superseded by ABLIKIM 19J.

NODE=M056R76;LINKAGE=B

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{41}/Γ
1.94±0.06±0.20	1.4k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$	

NODE=M056R87
NODE=M056R87

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R87;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{44}/Γ
<0.20	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.0	90	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$	

NODE=M056R08
NODE=M056R08

¹ ATHAR 07 reports $< 0.21 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R08;LINKAGE=AT

² ABLIKIM 06R reports $< 1.1 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R08;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{45}/Γ
<0.4	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.7	90	^{2,3} ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$	
<0.7	90	^{3,4} BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$	

NODE=M056R51
NODE=M056R51

¹ ATHAR 07 reports $< 0.38 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R51;LINKAGE=AT

 $\Gamma(K^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{46}/Γ
<0.09	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.7	90	^{2,3} ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$	
<0.7	90	^{3,4} BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$	

NODE=M056R17
NODE=M056R17

- ¹ ATHAR 07 reports $< 0.10 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.
- ² ABLIKIM 06R reports $< 0.70 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.
- ³ We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $K^0 K^+ \pi^-$.
- ⁴ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R17;LINKAGE=AT

NODE=M056R17;LINKAGE=AB

NODE=M056R17;LINKAGE=BA

NODE=M056R17;LINKAGE=X1

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.06	90	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.06 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.				

NODE=M056R05
NODE=M056R05

NODE=M056R05;LINKAGE=AT

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.23	90	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.24 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.75 \times 10^{-2}$.				

NODE=M056R09
NODE=M056R09

NODE=M056R09;LINKAGE=AT

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.48±0.03	16.8±4.8	¹ ABLIKIM 050	BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
¹ ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.138 \pm 0.039 \pm 0.025) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R48
NODE=M056R48

NODE=M056R48;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.8±0.5±0.1	319	¹ ABLIKIM 19AA	BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$
¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(5.64 \pm 0.33 \pm 0.37) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..				

NODE=M056R95
NODE=M056R95

NODE=M056R95;LINKAGE=A

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97±0.25±0.02	38	¹ ABLIKIM 06T	BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ ABLIKIM 06T reports $(1.03 \pm 0.22 \pm 0.15) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R01
NODE=M056R01

NODE=M056R01;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.68±0.30±0.50	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R90
NODE=M056R90 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.90±0.14±0.32	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R91
NODE=M056R91

$\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.18±0.07±0.13	538	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R88
NODE=M056R88

NODE=M056R88;LINKAGE=A

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.848±0.031 OUR FIT				
0.859±0.027±0.020	2701	¹ ABLIKIM	23N BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ Measured using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$ and $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

NODE=M056R16
NODE=M056R16

NODE=M056R16;LINKAGE=A

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.4±1.0±0.2	186.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma\phi\phi\eta$

¹ ABLIKIM 20B reports $(8.41 \pm 0.74 \pm 0.62) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R98
NODE=M056R98

NODE=M056R98;LINKAGE=A

 $\Gamma(\rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.70±0.07 OUR AVERAGE	Error includes scale factor of 1.3.		
0.73±0.06±0.02	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma\rho\bar{p}X$
0.56±0.12±0.01	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(7.76 \pm 0.37 \pm 0.51 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06
NODE=M056R06

NODE=M056R06;LINKAGE=ON

² ATHAR 07 reports $(0.59 \pm 0.10 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06;LINKAGE=AT

 $\Gamma(\rho\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.36±0.04 OUR AVERAGE	[(0.35 ± 0.04) × 10 ⁻³ OUR 2024 AVERAGE]		
0.35±0.04±0.01	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma\rho\bar{p}X$
0.37±0.11±0.01	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(3.73 \pm 0.38 \pm 0.28 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50
NODE=M056R50

NEW

NODE=M056R50;LINKAGE=ON

² ATHAR 07 reports $(0.39 \pm 0.11 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=AT

 $\Gamma(\rho\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.53±0.06±0.01	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma\rho\bar{p}X$

¹ ONYISI 10 reports $(5.57 \pm 0.48 \pm 0.42 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R70
NODE=M056R70

NODE=M056R70;LINKAGE=ON

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±1.4±0.1	42 ± 8	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M056R75
 NODE=M056R75

¹ ABLIKIM 11F reports $(6.12 \pm 1.18 \pm 0.86) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R75;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.1 ± 0.7 OUR EVALUATION	Error includes scale factor of 1.4. Treating systematic error as correlated.		

NODE=M056R7
 NODE=M056R7

→ UNCHECKED ←

2.1 ± 1.0 OUR AVERAGE Error includes scale factor of 2.0.

1.57 ± 0.21 ± 0.53	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
4.20 ± 1.15 ± 0.18	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R7;LINKAGE=X1

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.104±0.028±0.002	39.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

NODE=M056R65
 NODE=M056R65

¹ HE 08B reports $0.11 \pm 0.02 \pm 0.02 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R65;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.22±0.26±0.03	48 ± 8	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M056R72
 NODE=M056R72

¹ ABLIKIM 11F reports $(1.24 \pm 0.20 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R72;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.8	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

NODE=M056R46
 NODE=M056R46

¹ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.7±1.1 OUR AVERAGE				

NODE=M056R49
 NODE=M056R49

12.9 ± 1.1 ± 0.3	5150	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
11.3 ± 3.1 ± 0.3		² ABLIKIM	06I BES2	$\psi(2S) \rightarrow \gamma p\pi^- X$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (1.26 \pm 0.02 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AL

² ABLIKIM 06I reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (1.10 \pm 0.24 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AB

 $\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7±1.2±0.3	5808	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+$

NODE=M056R82
 NODE=M056R82

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (1.34 \pm 0.03 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R82;LINKAGE=AL

$\Gamma(\rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
23.5±2.1 OUR AVERAGE				[(23.4 ± 2.1) × 10 ⁻⁴ OUR 2024 AVERAGE]
23.5±2.0±0.5	2480	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-\pi^0$

NODE=M056R83
 NODE=M056R83

NEW

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (2.29 \pm 0.08 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R83;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.2±1.9 OUR AVERAGE				[(22.1 ± 1.9) × 10 ⁻⁴ OUR 2024 AVERAGE]
22.2±1.8±0.5	2757	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+\pi^0$

NODE=M056R84
 NODE=M056R84

NEW

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (2.16 \pm 0.07 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R84;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
118±12±3		426	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R44
 NODE=M056R44

••• We do not use the following data for averages, fits, limits, etc. •••

<400	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$
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¹ ABLIKIM 12I reports $(119.0 \pm 6.4 \pm 11.4) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R44;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R44;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R77
 NODE=M056R77

¹ ABLIKIM 12I reports $< 54 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R77;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M056R78
 NODE=M056R78

¹ ABLIKIM 12I reports $< 55 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R78;LINKAGE=AL

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Sigma(1385)^-\bar{\Lambda}\pi^+$

NODE=M056R79
 NODE=M056R79

¹ ABLIKIM 12I reports $< 50 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.

NODE=M056R79;LINKAGE=AL

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.25±0.12 OUR AVERAGE				Error includes scale factor of 1.3.
1.31±0.09±0.03	9k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$
1.01±0.19±0.02		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M056R07
 NODE=M056R07

¹ ABLIKIM 13D reports $(1.32 \pm 0.03 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07;LINKAGE=AB

² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

NODE=M056R07;LINKAGE=LB

³ ATHAR 07 reports $(1.07 \pm 0.17 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07;LINKAGE=AT

$\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.8±0.9±0.1	254	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$

NODE=M056R99
NODE=M056R99

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (4.7 \pm 0.7 \pm 0.5) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R99;LINKAGE=A

$\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0±0.7±0.1	62 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M056R73
NODE=M056R73

¹ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R73;LINKAGE=AB

$\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±0.5±0.2	1284	¹ ABLIKIM	21AV BES3	$\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$

NODE=M056P02
NODE=M056P02

¹ ABLIKIM 21AV reports $(6.65 \pm 0.26 \pm 0.41) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 0.0979 \pm 0.0020$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.

NODE=M056P02;LINKAGE=A

$\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.2±0.1	28 ± 10	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M056R74
NODE=M056R74

¹ ABLIKIM 11F reports $(3.18 \pm 1.11 \pm 0.53) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R74;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.70±0.32 OUR AVERAGE				

NODE=M056R59
NODE=M056R59

$[(4.69 \pm 0.32) \times 10^{-4}]$ OUR 2024 AVERAGE]

NEW

4.84±0.34±0.11 1046 ¹ ABLIKIM 18V BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

4.2 ±0.7 ±0.1 78 ± 10 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

••• We do not use the following data for averages, fits, limits, etc. •••

4.7 ±0.5 ±0.1 243 ^{3,4} ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (4.72 \pm 0.18 \pm 0.28) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R59;LINKAGE=A

² NAIK 08 reports $(4.41 \pm 0.56 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) =$

NODE=M056R59;LINKAGE=NA

= $(9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 13H reports $(4.78 \pm 0.34 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Superseded by ABLIKIM 18V

NODE=M056R59;LINKAGE=AB

NODE=M056R59;LINKAGE=B

$\Gamma(\Sigma^+ \bar{\Sigma}^-) / \Gamma_{\text{total}}$

Γ_{90} / Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M056R60
NODE=M056R60

4.7 ± 0.8 OUR AVERAGE Error includes scale factor of 2.6.

5.12 ± 0.35 ± 0.12 747 ¹ ABLIKIM 18V BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

3.1 ± 0.7 ± 0.1 39 ± 7 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.5 ± 0.5 ± 0.1 148 ^{3,4} ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M056R60;LINKAGE=A

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(4.99 \pm 0.24 \pm 0.24) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R60;LINKAGE=NA

² NAIK 08 reports $(3.25 \pm 0.57 \pm 0.43) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R60;LINKAGE=AB

³ ABLIKIM 13H reports $(4.54 \pm 0.42 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R60;LINKAGE=B

⁴ Superseded by ABLIKIM 18V

$\Gamma(\Sigma^+ \bar{\Sigma}^- \eta) / \Gamma_{\text{total}}$

Γ_{91} / Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M056P12
NODE=M056P12

12.7 ± 2.4 ± 0.3 74 ¹ ABLIKIM 24CA BES3 $\psi(2S) \rightarrow \gamma \chi_{c0}(1P)$

OCCUR=3

¹ ABLIKIM 24CA reports $(12.6 \pm 2.0 \pm 1.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^- \eta) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056P12;LINKAGE=A

$\Gamma(\Sigma^- \bar{\Sigma}^+) / \Gamma_{\text{total}}$

Γ_{92} / Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M056P00
NODE=M056P00

5.2 ± 0.5 OUR AVERAGE [(5.1 ± 0.5) × 10⁻⁴ OUR 2024 AVERAGE]

NEW

5.2 ± 0.5 ± 0.1 2143 ¹ ABLIKIM 20I BES3 $\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

NODE=M056P00;LINKAGE=A

¹ ABLIKIM 20I reports $(5.13 \pm 0.24 \pm 0.41) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-) / \Gamma_{\text{total}}$

Γ_{93} / Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M056R80
NODE=M056R80

16.3 ± 5.9 ± 0.4 27 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R80;LINKAGE=AL

¹ ABLIKIM 12I reports $(16.4 \pm 5.7 \pm 1.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
23 ± 7 ± 1	33	¹ ABLIKIM	12I	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R81
 NODE=M056R81

¹ ABLIKIM 12I reports $(23.5 \pm 6.2 \pm 2.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R81;LINKAGE=AL

 $\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.95 ± 0.35 ± 0.04	57	¹ ABLIKIM	15I	BES3 $\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$

NODE=M056R92
 NODE=M056R92

¹ ABLIKIM 15I reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (1.90 \pm 0.30 \pm 0.16) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R92;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.5 OUR AVERAGE				Error includes scale factor of 1.7.

NODE=M056R61
 NODE=M056R61

4.69 ± 0.31 ± 0.11	1741	¹ ABLIKIM	220	BES3 $\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
3.2 ± 0.8 ± 0.1	23.3 ± 4.9	² NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

¹ ABLIKIM 220 reports $(4.67 \pm 0.19 \pm 0.26) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61;LINKAGE=A

² NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.48 ± 0.20 OUR AVERAGE					

NODE=M056R45
 NODE=M056R45

[(4.47 ± 0.20) × 10⁻⁴ OUR 2024 AVERAGE]

4.45 ± 0.18 ± 0.10	4932	¹ ABLIKIM	220	BES3 $\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$
4.9 ± 0.7 ± 0.1	95	² NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10.3	90	³ ABLIKIM	06D	BES2 $\psi(2S) \rightarrow \chi_{c0} \gamma$
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¹ ABLIKIM 220 reports $(4.43 \pm 0.08 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R45;LINKAGE=A

² NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R45;LINKAGE=NA

³ Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45;LINKAGE=AB

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.51 ± 0.54 ± 0.29	284	ABLIKIM	23T	BES3 $\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$

NODE=M056P04
 NODE=M056P04

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 7 × 10⁻⁴	90	^{1,2} ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R89
 NODE=M056R89

<41 × 10 ⁻⁴	90	^{1,3} ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
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OCCUR=2

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R89;LINKAGE=A

² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.

NODE=M056R89;LINKAGE=B

³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.

NODE=M056R89;LINKAGE=C

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\pi\pi)/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma \times \Gamma_{32}/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT		
18.9±1.6 OUR FIT	Error includes scale factor of 1.5. $[(18.9 \pm 1.5) \times 10^{-7} \text{ OUR 2024 FIT Scale factor} = 1.5]$				NODE=M056R21 NODE=M056R21 NEW
15.3±2.4±0.8	¹ ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$		NODE=M056R;LINKAGE=AD
¹ We have multiplied $B(\rho\bar{\rho}) \cdot B(\pi^0\pi^0)$ measurement by 3 to obtain $B(\rho\bar{\rho}) \cdot B(\pi\pi)$.					
$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\pi^0\eta)/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma \times \Gamma_{33}/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT		
<0.4	ANDREOTTI	05C	E835 $\bar{p}p \rightarrow \pi^0\eta$		NODE=M056R41 NODE=M056R41
$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\pi^0\eta')/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma \times \Gamma_{34}/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT		
<2.5	ANDREOTTI	05C	E835 $\bar{p}p \rightarrow \pi^0\eta$		NODE=M056R42 NODE=M056R42
$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma \times \Gamma_{36}/\Gamma$	
VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT		
6.7±0.7 OUR FIT	Error includes scale factor of 1.4.				NODE=M056R40 NODE=M056R40
4.0±1.2^{+0.5}_{-0.3}	ANDREOTTI	05C	E835 $\bar{p}p \rightarrow \eta\eta$		
$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$				$\Gamma_{59}/\Gamma \times \Gamma_{37}/\Gamma$	
VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT		
•••	We do not use the following data for averages, fits, limits, etc. •••				NODE=M056R43 NODE=M056R43
2.1^{+2.3}_{-1.5}	ANDREOTTI	05C	E835 $\bar{p}p \rightarrow \pi^0\eta$		

————— RADIATIVE DECAYS —————

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$				Γ_{101}/Γ		
VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
< 9	90	1.2 ± 4.5	¹ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$	NODE=M056R56 NODE=M056R56
••• We do not use the following data for averages, fits, limits, etc. •••						
<10	90	6 ± 12	² ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$	NODE=M056R56;LINKAGE=BE
¹ BENNETT 08A reports $< 9.6 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						
² ABLIKIM 11E reports $< 10.5 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						
$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$				Γ_{102}/Γ		
VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
< 8	90	0.0 ± 2.8	¹ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$	NODE=M056R57 NODE=M056R57
••• We do not use the following data for averages, fits, limits, etc. •••						
<13	90	5 ± 11	² ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\omega$	NODE=M056R57;LINKAGE=BE
¹ BENNETT 08A reports $< 8.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						
² ABLIKIM 11E reports $< 12.9 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						
$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$				Γ_{103}/Γ		
VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
< 6	90	0.1 ± 1.6	¹ BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\phi$	NODE=M056R58 NODE=M056R58
••• We do not use the following data for averages, fits, limits, etc. •••						
<16	90	15 ± 7	² ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$	NODE=M056R58;LINKAGE=BE
¹ BENNETT 08A reports $< 6.4 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						
² ABLIKIM 11E reports $< 16.2 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.75 \times 10^{-2}$.						

$\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M056R93
 NODE=M056R93

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.55 ± 0.33 ± 0.03	56	1,2 ABLIKIM	17I	BES3	$\psi(2S) \rightarrow \gamma e^+ e^- J/\psi$
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¹ ABLIKIM 17I reports $(1.51 \pm 0.30 \pm 0.13) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow e^+ e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R93;LINKAGE=B

² Not independent from other measurements reported by ABLIKIM 17I

NODE=M056R93;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ $\Gamma_{105}/\Gamma_{100}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M056R94
 NODE=M056R94

9.5 ± 1.9 ± 0.7	56	¹ ABLIKIM	17I	BES3	$\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$
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¹ Uses $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) \times B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (15.8 \pm 0.3 \pm 0.6) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M056R94;LINKAGE=A

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$ $\Gamma_{106}/\Gamma_{105}$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M056R97
 NODE=M056R97

<0.14	90	<9.5	ABLIKIM	19Z	BES3	$\psi(2S) \rightarrow \gamma \chi_c \rightarrow \gamma(\mu^+ \mu^- J/\psi)$
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 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ $\Gamma_{104}/\Gamma_{100}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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NODE=M056R18
 NODE=M056R18

1.46 ± 0.13 OUR FIT Error includes scale factor of 1.6. $[(1.45 \pm 0.13) \times 10^{-2}$ OUR 2024 FIT Scale factor = 1.6]

NEW

2.0 ± 0.4 OUR AVERAGE

2.2 ± 0.4 ^{+0.1} / _{-0.2}	¹ ANDREOTTI	04	E835	$p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$
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1.45 ± 0.74	² AMBROGIANI	00B	E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$
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¹ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.

NODE=M056R;LINKAGE=AN

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{59}/\Gamma \times \Gamma_{100}/\Gamma$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M056R19
 NODE=M056R19

31.2 ± 2.2 OUR FIT Error includes scale factor of 1.4. $[(31.1 \pm 2.2) \times 10^{-7}$ OUR 2024 FIT Scale factor = 1.4]

NEW

28.2 ± 2.1 OUR AVERAGE

28.0 ± 1.9 ± 1.3	392	1,2,3 BAGNASCO	02	E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
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29.3 ^{+5.7} / _{-4.7} ± 1.5	89	1,2 AMBROGIANI	99B		$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
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¹ Values in $(\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ and $(\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ are not independent. The latter is used in the fit since it is less correlated to the total width.

NODE=M056R;LINKAGE=KS

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R19;LINKAGE=7A
 NODE=M056R19;LINKAGE=AN

³ Recalculated by ANDREOTTI 05A.

 $\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

 $\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$
 $\Gamma_1/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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NODE=M056B4
 NODE=M056B4

6.12 ± 0.26 OUR FIT Error includes scale factor of 1.1. $[(6.6 \pm 1.0) \times 10^{-3}$ OUR 2024 FIT Scale factor = 2.0]

NEW

6.9 ± 2.4 OUR AVERAGE Error includes scale factor of 3.8.

4.4 ± 0.1 ± 0.9	¹ BAI	99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
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9.3 ± 0.9	² TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$
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¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B;LINKAGE=B2

² The value $B(\psi(1S) \rightarrow \gamma \chi_{c0}) \times B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B;LINKAGE=J1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \frac{\Gamma_1/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.12 ± 0.09 OUR FIT Error includes scale factor of 1.1.

2.082 ± 0.002 ± 0.089 1946 ¹ ABLIKIM 24BT BES3 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Calculated by us. The value given here is derived from the value of $B(\chi_{c0} \rightarrow 2(\pi^+ \pi^-))$ reported in ABLIKIM 24BT using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.79 \pm 0.20)\%$ [PDG 22].

NODE=M056P09
NODE=M056P09

NODE=M056P09;LINKAGE=A

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \frac{\Gamma_8/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}}$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
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1.77 ± 0.15 OUR FIT Error includes scale factor of 1.1. $[(1.78 \pm 0.15) \times 10^{-3} \text{ OUR 2024 FIT Scale factor} = 1.1]$

1.64 ± 0.05 ± 0.2 ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B18
NODE=M056B18

NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \frac{\Gamma_8/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181} \Gamma_{12}}$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
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5.1 ± 0.4 OUR FIT Error includes scale factor of 1.1.

5.8 ± 1.6 OUR AVERAGE Error includes scale factor of 2.3.

4.22 ± 0.20 ± 0.97 BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$

7.4 ± 1.0 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B19
NODE=M056B19

NODE=M056B19;LINKAGE=TA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \frac{\Gamma_{32}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
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8.33 ± 0.34 OUR FIT Error includes scale factor of 1.2. $[(8.34 \pm 0.34) \times 10^{-4} \text{ OUR 2024 FIT Scale factor} = 1.2]$

8.80 ± 0.34 OUR AVERAGE

9.11 ± 0.08 ± 0.65 ¹ ABLIKIM 10A BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

8.81 ± 0.11 ± 0.43 8.9k ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

8.13 ± 0.19 ± 0.89 2.8k ³ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (3.23 \pm 0.03 \pm 0.23 \pm 0.14) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^+ \pi^-) = (6.37 \pm 0.08 \pm 0.31 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

³ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (2.94 \pm 0.07 \pm 0.32 \pm 0.15) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

NODE=M056B22
NODE=M056B22

NEW

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \frac{\Gamma_{32}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181} \Gamma_{12}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
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24.0 ± 1.0 OUR FIT Error includes scale factor of 1.2.

20.7 ± 1.7 OUR AVERAGE

23.9 ± 2.7 ± 4.1 97 ± 11 ¹ BAI 03C BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^0 \pi^0$

20.2 ± 1.1 ± 1.5 720 ± 32 ² BAI 98i BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^+ \pi^-$

¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

² Calculated by us. The value for $B(\chi_{c0} \rightarrow \pi^+ \pi^-)$ reported in BAI 98i is derived using $B(\psi' \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi' \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

NODE=M056B5
NODE=M056B5

NODE=M056B;LINKAGE=D1

NODE=M056B;LINKAGE=D2

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{36}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.94±0.22 OUR FIT Error includes scale factor of 1.2.

3.12±0.19 OUR AVERAGE

3.23±0.09±0.23	2132	¹ ABLIKIM	10A BES3	e ⁺ e ⁻ → ψ(2S) → γχ _{c0}
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2.93±0.12±0.29	0.9k	² ASNER	09 CLEO	ψ(2S) → γηη
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.86±0.46±0.37	48	³ ADAMS	07 CLEO	ψ(2S) → γχ _{c0}
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¹ Calculated by us. ABLIKIM 10A reports B(χ_{c0} → ηη) = (3.44 ± 0.10 ± 0.24 ± 0.13) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.4 ± 0.4)%.

² Calculated by us. ASNER 09 reports B(χ_{c0} → ηη) = (3.18 ± 0.13 ± 0.31 ± 0.16) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

³ Superseded by ASNER 09. Calculated by us. The value of B(χ_{c0}(1P) → ηη) reported by ADAMS 07 was derived using B(ψ(2S) → γχ_{c0}(1P)) = (9.22 ± 0.11 ± 0.46)% (ATHAR 04).

NODE=M056B11
NODE=M056B11

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{36}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
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0.85 ±0.06 OUR FIT Error includes scale factor of 1.2.

0.578±0.241±0.158	BAI	03C BES	ψ(2S) → γηη
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NODE=M056B10
NODE=M056B10

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{42}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.92±0.28 OUR FIT

[(5.93 ± 0.28) × 10⁻⁴ OUR 2024 FIT]

5.97±0.07±0.32	8.1k	¹ ASNER	09 CLEO	ψ(2S) → γK ⁺ K ⁻
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¹ Calculated by us. ASNER 09 reports B(χ_{c0} → K⁺K⁻) = (6.47 ± 0.08 ± 0.35 ± 0.32) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

NODE=M056B23
NODE=M056B23

NEW

NODE=M056B23;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{42}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.71±0.08 OUR FIT

1.63±0.10±0.15	774 ± 38	¹ BAI	98I BES	ψ(2S) → γK ⁺ K ⁻
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¹ Calculated by us. The value for B(χ_{c0} → K⁺K⁻) reported by BAI 98I is derived using B(ψ(2S) → γχ_{c0}) = (9.3 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B9
NODE=M056B9

NODE=M056B9;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{43}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma\psi(2S)}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
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3.10±0.16 OUR FIT

3.18±0.17 OUR AVERAGE

3.22±0.07±0.17	2.1k	¹ ASNER	09 CLEO	ψ(2S) → γK _S ⁰ K _S ⁰
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3.02±0.19±0.33	322	ABLIKIM	050 BES2	ψ(2S) → γK _S ⁰ K _S ⁰
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¹ Calculated by us. ASNER 09 reports B(χ_{c0} → K_S⁰K_S⁰) = (3.49 ± 0.08 ± 0.18 ± 0.17) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

NODE=M056B12
NODE=M056B12

NODE=M056B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{43}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10 ⁻⁴)	DOCUMENT ID	TECN	COMMENT
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8.9±0.5 OUR FIT

5.6±0.8±1.3	¹ BAI	99B BES	ψ(2S) → γK _S ⁰ K _S ⁰
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¹ Calculated by us. The value of B(χ_{c0} → K_S⁰K_S⁰) reported by BAI 99B was derived using B(ψ(2S) → γχ_{c0}(1P)) = (9.3 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B13
NODE=M056B13

NODE=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{51}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.4 OUR FIT				Error includes scale factor of 1.5. [(2.8 ± 0.4) × 10 ⁻⁴ OUR 2024 FIT Scale factor = 1.5]

NODE=M056B14
NODE=M056B14

NEW

3.20 ± 0.11 ± 0.41	278	¹ ABLIKIM	06T	BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
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¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} / \frac{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{51}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.0 ± 1.2 OUR FIT			Error includes scale factor of 1.5. [(8.0 ± 1.2) × 10 ⁻⁴ OUR 2024 FIT Scale factor = 1.5]

NODE=M056B15
NODE=M056B15

NEW

6.1 ± 0.8 ± 0.9		¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
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¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 3(K^+ K^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{55}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
10.5 ± 1.8 ± 1.1	37.7 ± 6.2	¹ ABLIKIM	24P	BES3 $e^+ e^- \rightarrow \psi(2S)$

NODE=M056P06
NODE=M056P06

¹ Systematic error derived by us, based on the text.

NODE=M056P06;LINKAGE=A

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{57}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.827 ± 0.033 OUR FIT				[(0.829 ± 0.034) × 10 ⁻⁴ OUR 2024 FIT]

NODE=M056B16
NODE=M056B16

NEW

0.78 ± 0.08 OUR AVERAGE				
0.77 ± 0.03 ± 0.08	612	¹ ABLIKIM	11K	BES3 $\psi(2S) \rightarrow \gamma$ hadrons
0.86 ± 0.19 ± 0.12	26	² ABLIKIM	06T	BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

NODE=M056B16;LINKAGE=AL

² Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{57}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.38 ± 0.10 OUR FIT			[(2.39 ± 0.10) × 10 ⁻⁴ OUR 2024 FIT]

NODE=M056B17
NODE=M056B17

NEW

2.6 ± 1.0 ± 1.1		¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
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¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{59}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
21.6 ± 1.3 OUR FIT				Error includes scale factor of 1.5. [(21.6 ± 1.3) × 10 ⁻⁶ OUR 2024 FIT Scale factor = 1.5]

NODE=M056B6
NODE=M056B6

NEW

23.7 ± 1.0 OUR AVERAGE				
23.7 ± 0.8 ± 0.9	1222	ABLIKIM	13v	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$
23.7 ± 1.4 ± 1.4	383 ± 22	¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$
23.6 ^{+3.7} _{-3.4} ± 3.4	89.5 ⁺¹⁴ ₋₁₃	BAI	04F	BES $\psi(2S) \rightarrow \gamma \chi_{c0}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{59}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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6.2±0.4 OUR FIT Error includes scale factor of 1.5. $[(6.2 \pm 0.4) \times 10^{-5}]$ OUR 2024 FIT Scale factor = 1.5]

4.6±1.9 ¹BAI 98I BES $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma\bar{p}p$

¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B1
NODE=M056B1

NEW

NODE=M056B;LINKAGE=B1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}K_S^0K^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{68}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.55±0.26±0.31 173 ABLIKIM 24BX BES3 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056P10
NODE=M056P10

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}\Lambda(1520)K_S^0\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{85}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.57^{+0.66}_{-0.62}±0.22 27 ABLIKIM 24BX BES3 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056P11
NODE=M056P11

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{73}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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35.2±1.3 OUR FIT

35.1±1.4 OUR AVERAGE Error includes scale factor of 1.1.

35.6±1.0±1.0 1486 ABLIKIM 21L BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+$

31.2±3.3±2.0 131 ¹NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

32.0±1.9±2.2 369 ^{2,3}ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

² Superseded by ABLIKIM 21L

³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.3 \pm 2.0 \pm 2.6) \times 10^{-5}$ from a measurement of $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c0})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.62 \pm 0.31)\%$.

NODE=M056B20
NODE=M056B20

NODE=M056B20;LINKAGE=NA

NODE=M056B20;LINKAGE=A
NODE=M056B20;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{73}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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10.1±0.4 OUR FIT

13.0^{+3.6}_{-3.5}±2.5 15.2^{+4.2}_{-4.0} ¹BAI 03E BES $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c0}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-p) / B(J/\psi \rightarrow p\bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^-p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M056B21
NODE=M056B21

NODE=M056B21;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{78}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.26±0.30±0.20 67 ABLIKIM 22AO BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+\gamma\gamma$

NODE=M056P03
NODE=M056P03

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\omega)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{79}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
--------------------------	------	-------------	------	---------

23.2±2.2±2.4 316 ± 30 ¹ABLIKIM 24BE BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056P07
NODE=M056P07

¹ Calculated by us. The authors report $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}\omega)$ obtained from a product using PDG 22 value of $B(\psi(2S) \rightarrow \gamma\chi_{c0})$.

NODE=M056P07;LINKAGE=A

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda} \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{80} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.92±1.22±0.19	7.2	ABLIKIM	24AC BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056P05
NODE=M056P05

$$\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{88} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.45±0.17±0.19	493	¹ ABLIKIM	19BB BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

NODE=M056B24
NODE=M056B24

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_c^0 \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (3.52 \pm 0.19 \pm 0.21) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_c^0) = (9.79 \pm 0.20)\%$ and other branching fractions from PDG 18.

NODE=M056B24;LINKAGE=A

$$\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{89} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.97±0.12±0.14	871	¹ ABLIKIM	20AE BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

NODE=M056P01
NODE=M056P01

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_c^0 \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (3.03 \pm 0.12 \pm 0.15) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_c^0) = (9.79 \pm 0.20)\%$ and other branching fractions from PDG 20.

NODE=M056P01;LINKAGE=A

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{100} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.137±0.009 OUR FIT		Error includes scale factor of 1.7.		
0.147±0.029 OUR AVERAGE		Error includes scale factor of 4.6.		

0.158±0.003±0.006	4.8k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$
0.024±0.015±0.205	12k	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
0.069±0.018		² OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.4 ±0.3		³ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.16 ±0.11		³ BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma \chi_{c0}$
3.3 ±1.7		⁴ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.151±0.003±0.010	4.3k	⁵ ABLIKIM	12O BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.125±0.007±0.013	560	⁶ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0}$
0.18 ±0.01 ±0.02	172	⁷ ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

⁴ Assumes isotropic gamma distribution.

⁵ Superseded by ABLIKIM 17N.

⁶ Not independent from other measurements of MENDEZ 08.

⁷ Not independent from other values reported by ADAM 05A.

NODE=M056B2
NODE=M056B2

NODE=M056B2;LINKAGE=A

NODE=M056B;LINKAGE=3Q
NODE=M056B;LINKAGE=2Q
NODE=M056B;LINKAGE=EA
NODE=M056B2;LINKAGE=B
NODE=M056B2;LINKAGE=ME
NODE=M056B2;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\psi(2S)}$$

$$\Gamma_{100} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.396±0.025 OUR FIT		Error includes scale factor of 1.7.		
0.358±0.020±0.037	560	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.55 ±0.04 ±0.06	172	¹ ADAM	05A CLEO	Repl. by MENDEZ 08
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¹ Not independent from other values reported by ADAM 05A.

NODE=M056B8
NODE=M056B8

NODE=M056B;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{104}}{\Gamma} \times \frac{\Gamma^{\psi(2S)}}{\Gamma^{\psi(2S)_{181}}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00±0.09 OUR FIT	Error includes scale factor of 1.1.			[(2.00 ± 0.09) × 10 ⁻⁵ OUR 2024 FIT]
1.95±0.09 OUR AVERAGE				
1.93±0.08±0.05	3.5k	ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow 3\gamma$
2.17±0.32±0.10	0.2k	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow 3\gamma$
3.7 ±1.8 ±1.0		LEE	85 CBAL	$\psi(2S) \rightarrow \gamma\chi_{c0}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.17±0.17±0.12	0.8k	¹ ABLIKIM	12A BES3	$\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow 3\gamma$
¹ Superseded by ABLIKIM 17AE.				

NODE=M056B3
 NODE=M056B3

NEW

NODE=M056B3;LINKAGE=A

$\chi_{c0}(1P)$ REFERENCES

ABLIKIM	24AC	PR D110 032016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62682
ABLIKIM	24BE	PR D110 032022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62904
ABLIKIM	24BT	PR D110 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63025
ABLIKIM	24BX	PR D110 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63029
ABLIKIM	24CA	PR D110 112013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63032
ABLIKIM	24P	PR D109 072016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62667
ABLIKIM	23N	JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM	23T	PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
ABLIKIM	22AO	PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM	22O	JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AV	JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026
ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310
ABLIKIM	17AI	PR D96 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58321
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56779
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54266
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
ABLIKIM	10A	PR D81 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53347
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52721
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447

NODE=M056

ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ANDREOTTI	05C	PR D72 112002	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50991
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ANDREOTTI	04	PL B584 16	M. Andreotti <i>et al.</i>	(E835 Collab.)	REFID=49744
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
ANDREOTTI	03	PRL 91 091801	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=49578
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAGNASCO	02	PL B533 237	S. Bagnasco <i>et al.</i>	(FNAL E835 Collab.)	REFID=48833
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
AMBROGIANI	99B	PRL 83 2902	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47389
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059

NODE=M055

$$\chi_{c1}(1P)$$

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the Review on "Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ " before the $\chi_{c0}(1P)$ Listings.

NODE=M055

$\chi_{c1}(1P)$ MASS

NODE=M055M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.67 ± 0.05	OUR AVERAGE	Error includes scale factor of 1.2.		
3509.84 ± 0.69 ± 0.64	2.8k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+ (K_S^0 K \pi)$
3508.4 ± 1.9 ± 0.7	460	¹ AAIJ	17BB LHCB	$p p \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$
3510.71 ± 0.04 ± 0.09	4.8k	² AAIJ	17BI LHCB	$\chi_{c1} \rightarrow J/\psi \mu^+ \mu^-$
3510.30 ± 0.14 ± 0.16		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3510.719 ± 0.051 ± 0.019		ANDREOTTI	05A E835	$p \bar{p} \rightarrow e^+ e^- \gamma$
3509.4 ± 0.9		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3510.60 ± 0.087 ± 0.019	513	³ ARMSTRONG	92 E760	$\bar{p} p \rightarrow e^+ e^- \gamma$
3511.3 ± 0.4 ± 0.4	30	BAGLIN	86B SPEC	$\bar{p} p \rightarrow e^+ e^- X$
3512.3 ± 0.3 ± 4.0		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 ± 1.7	91	⁵ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3510.4 ± 0.6		OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3510.1 ± 1.1	254	⁶ HIMEL	80 MRK2	$e^+ e^- \rightarrow J/\psi 2\gamma$
3509 ± 11	21	BRANDELIK	79B DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
3507 ± 3		⁶ BARTEL	78B CNTR	$e^+ e^- \rightarrow J/\psi 2\gamma$
3505.0 ± 4 ± 4		^{6,7} TANENBAUM	78 MRK1	$e^+ e^-$
3513 ± 7	367	⁶ BIDDICK	77 CNTR	$\psi(2S) \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3500 ± 10	40	TANENBAUM	75 MRK1	Hadrons γ

NODE=M055M

OCCUR=2

- ¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c1}(1P)$ fixed to the PDG 16 value.
² AAIJ 17Bl reports also $m(\chi_{c2}) - m(\chi_{c1}) = 45.39 \pm 0.07 \pm 0.03$ MeV.
³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.
⁴ Using mass of $\psi(2S) = 3686.0$ MeV.
⁵ $J/\psi(1S)$ mass constrained to 3097 MeV.
⁶ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.
⁷ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M055M;LINKAGE=A

NODE=M055M;LINKAGE=B

NODE=M055M;LINKAGE=NW

NODE=M055M;LINKAGE=C

NODE=M055M;LINKAGE=P

NODE=M055M;LINKAGE=D

NODE=M055M;LINKAGE=M

 $\chi_{c1}(1P)$ WIDTH

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.84 ±0.04 OUR FIT	Error includes scale factor of 1.1.			
0.88 ±0.05 OUR AVERAGE				
1.39 ^{+0.40} _{-0.38} ^{+0.26} _{-0.77}		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
0.876 ±0.045 ±0.026		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
0.87 ±0.11 ±0.08	513	¹ ARMSTRONG	92 E760	$p\bar{p} \rightarrow e^+e^-\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<1.3	95	BAGLIN	86B SPEC	$p\bar{p} \rightarrow e^+e^-X$
<3.8	90	GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
¹ Recalculated by ANDREOTTI 05A.				

NODE=M055W

NODE=M055W

NODE=M055W;LINKAGE=AN

 $\chi_{c1}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 hadrons		
Γ_2 e^+e^-	$(1.4 \pm_{-1.0}^{+1.5}) \times 10^{-7}$	
Hadronic decays		
Γ_3 $3(\pi^+\pi^-)$	$(1.04 \pm 0.16) \%$	S=4.6
Γ_4 $2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$	
Γ_5 $\pi^+\pi^-\pi^0\pi^0$	$(1.19 \pm 0.15) \%$	
Γ_6 $\rho^+\pi^-\pi^0 + c.c.$	$(1.45 \pm 0.24) \%$	
Γ_7 $\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$	
Γ_8 $4\pi^0$	$(5.4 \pm 0.8) \times 10^{-4}$	
Γ_9 $\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$	
Γ_{10} $K^+K^-\pi^0\pi^0$	$(1.12 \pm 0.27) \times 10^{-3}$	
Γ_{11} $K^+K^-\pi^+\pi^-\pi^0$	$(1.15 \pm 0.13) \%$	
Γ_{12} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(7.5 \pm 0.8) \times 10^{-3}$	
Γ_{13} $K^+\pi^-\bar{K}^0\pi^0 + c.c.$	$(8.6 \pm 1.4) \times 10^{-3}$	
Γ_{14} $\rho^-K^+\bar{K}^0 + c.c.$	$(5.0 \pm 1.2) \times 10^{-3}$	
Γ_{15} $K^*(892)^0\bar{K}^0\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + c.c.$	$(2.3 \pm 0.6) \times 10^{-3}$	
Γ_{16} $K^+K^-\eta\pi^0$	$(1.12 \pm 0.34) \times 10^{-3}$	
Γ_{17} $\pi^+\pi^-K_S^0K_S^0$	$(6.9 \pm 2.9) \times 10^{-4}$	
Γ_{18} $K^+K^-\eta$	$(3.2 \pm 1.0) \times 10^{-4}$	
Γ_{19} $\bar{K}^0K^+\pi^- + c.c.$	$(7.0 \pm 0.6) \times 10^{-3}$	S=1.1
Γ_{20} $K^*(892)^0\bar{K}^0 + c.c.$	$(1.03 \pm 0.15) \times 10^{-3}$	
Γ_{21} $K^*(892)^+K^- + c.c.$	$(1.21 \pm 0.23) \times 10^{-3}$	
Γ_{22} $K_J^*(1430)^0\bar{K}^0 + c.c. \rightarrow K_S^0K^+\pi^- + c.c.$	$< 8 \times 10^{-4}$	CL=90%
Γ_{23} $K_J^*(1430)^+K^- + c.c. \rightarrow K_S^0K^+\pi^- + c.c.$	$< 2.1 \times 10^{-3}$	CL=90%
Γ_{24} $K^+K^-\pi^0$	$(1.81 \pm 0.24) \times 10^{-3}$	
Γ_{25} $\eta\pi^+\pi^-$	$(4.62 \pm 0.24) \times 10^{-3}$	
Γ_{26} $a_0(980)^+\pi^- + c.c. \rightarrow \eta\pi^+\pi^-$	$(3.2 \pm 0.4) \times 10^{-3}$	S=2.1
Γ_{27} $a_2(1320)^+\pi^- + c.c. \rightarrow \eta\pi^+\pi^-$	$(1.76 \pm 0.24) \times 10^{-4}$	
Γ_{28} $a_2(1700)^+\pi^- + c.c. \rightarrow \eta\pi^+\pi^-$	$(4.6 \pm 0.7) \times 10^{-5}$	
Γ_{29} $f_2(1270)\eta \rightarrow \eta\pi^+\pi^-$	$(3.5 \pm 0.6) \times 10^{-4}$	
Γ_{30} $f_4(2050)\eta \rightarrow \eta\pi^+\pi^-$	$(2.5 \pm 0.9) \times 10^{-5}$	

NODE=M055215;NODE=M055

DESIG=112

DESIG=110

NODE=M055;CLUMP=A

DESIG=6

DESIG=5

DESIG=51

DESIG=52

DESIG=9

DESIG=60

DESIG=7

DESIG=53

DESIG=79

DESIG=84

DESIG=55

DESIG=56

DESIG=57

DESIG=58

DESIG=28

DESIG=42

DESIG=17

DESIG=32

DESIG=33

DESIG=34

DESIG=35

DESIG=38

DESIG=31

DESIG=36

DESIG=93

DESIG=96

DESIG=94

DESIG=95

Г31	$\pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$< 5 \times 10^{-5}$	CL=90%	DESIG=97
Г32	$\pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=98
Г33	$\pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-$	$< 8 \times 10^{-6}$	CL=90%	DESIG=99
Г34	$f_2(1270) \eta$	$(6.7 \pm 1.1) \times 10^{-4}$		DESIG=37
Г35	$\pi^+ \pi^- \eta'$	$(2.2 \pm 0.4) \times 10^{-3}$		DESIG=44
Г36	$K^+ K^- \eta'(958)$	$(8.8 \pm 0.9) \times 10^{-4}$		DESIG=85
Г37	$K_0^*(1430)^+ K^- + \text{c.c.}$	$(6.4 \pm_{-2.8}^{+2.2}) \times 10^{-4}$		DESIG=86
Г38	$f_0(980) \eta'(958)$	$(1.6 \pm_{-0.7}^{+1.4}) \times 10^{-4}$		DESIG=87
Г39	$f_0(1710) \eta'(958)$	$(7 \pm_{-5}^{+7}) \times 10^{-5}$		DESIG=88
Г40	$f_2'(1525) \eta'(958)$	$(9 \pm 6) \times 10^{-5}$		DESIG=89
Г41	$K_2^*(1430)^+ K^- + \text{c.c.}$	$(1.61 \pm 0.31) \times 10^{-3}$		DESIG=115
Г42	$K_2^*(1430) \bar{K}^0 + \text{c.c.}$	$(1.17 \pm 0.20) \times 10^{-3}$		DESIG=116
Г43	$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$		DESIG=61
Г44	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		DESIG=10
Г45	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$		DESIG=21
Г46	$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=29
Г47	$K_S^0 K_S^0 K_S^0 K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$		DESIG=102
Г48	$K^+ K^- K^+ K^-$	$(5.4 \pm 1.1) \times 10^{-4}$		DESIG=14
Г49	$K^+ K^- \phi$	$(4.1 \pm 1.5) \times 10^{-4}$		DESIG=30
Г50	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		DESIG=90
Г51	$K^+ K^- \pi^0 \phi$	$(1.62 \pm 0.30) \times 10^{-3}$		DESIG=91
Г52	$3(K^+ K^-)$	$(4.2 \pm 1.1) \times 10^{-6}$		DESIG=119
Г53	$\phi \pi^+ \pi^- \pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		DESIG=82
Г54	$\omega \omega$	$(5.7 \pm 0.7) \times 10^{-4}$		DESIG=66
Г55	$\omega K^+ K^-$	$(7.8 \pm 0.9) \times 10^{-4}$		DESIG=81
Г56	$\omega \phi$	$(2.7 \pm 0.4) \times 10^{-5}$		DESIG=67
Г57	$\phi \phi$	$(4.26 \pm 0.21) \times 10^{-4}$		DESIG=68
Г58	$\phi \phi \eta$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=104
Г59	$\rho \bar{\rho}$	$(7.6 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=11
Г60	$\rho \bar{\rho} \pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$		DESIG=39
Г61	$\rho \bar{\rho} \eta$	$(1.45 \pm 0.25) \times 10^{-4}$		DESIG=43
Г62	$\rho \bar{\rho} \omega$	$(2.12 \pm 0.31) \times 10^{-4}$		DESIG=59
Г63	$\rho \bar{\rho} \phi$	$< 1.7 \times 10^{-5}$	CL=90%	DESIG=65
Г64	$\rho \bar{\rho} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		DESIG=8
Г65	$\rho \bar{\rho} \pi^0 \pi^0$	$< 5 \times 10^{-4}$	CL=90%	DESIG=54
Г66	$\rho \bar{\rho} K^+ K^- (\text{non-resonant})$	$(1.27 \pm 0.22) \times 10^{-4}$		DESIG=62
Г67	$\rho \bar{\rho} K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
Г68	$\rho \bar{\rho} K_S^0 K^- \pi^+ + \text{c.c.}$	$(4.2 \pm 0.5) \times 10^{-5}$		DESIG=120
Г69	$\rho \bar{n} \pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=74
Г70	$\bar{\rho} n \pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=75
Г71	$\rho \bar{n} \pi^- \pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		DESIG=76
Г72	$\bar{\rho} n \pi^+ \pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$		DESIG=77
Г73	$\Lambda \bar{\Lambda}$	$(1.27 \pm 0.09) \times 10^{-4}$	S=1.1	DESIG=19
Г74	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		DESIG=24
Г75	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=69
Г76	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=70
Г77	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=71
Г78	$\Lambda \bar{\Lambda} \eta$	$(5.9 \pm 1.5) \times 10^{-5}$		DESIG=111
Г79	$\Lambda \bar{\Lambda} \omega$	$(1.01 \pm 0.16) \times 10^{-4}$		DESIG=118
Г80	$\Lambda \bar{\Lambda} \phi$	$(6.0 \pm 1.0) \times 10^{-5}$		DESIG=117
Г81	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2	DESIG=40
Г82	$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(1.66 \pm 0.17) \times 10^{-4}$		DESIG=109
Г83	$\bar{p} \Lambda(1520) K_S^0 \pi^+ + \text{c.c.}$	$(4.1 \pm 0.9) \times 10^{-5}$		DESIG=121
Г84	$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		DESIG=106
Г85	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		DESIG=63

Γ ₈₆	$\Lambda(1520)\bar{\Lambda}(1520)$	< 9	$\times 10^{-5}$	CL=90%	DESIG=64
Γ ₈₇	$\Sigma^0\bar{\Sigma}^0$	(4.2 ± 0.6)	$\times 10^{-5}$		DESIG=48
Γ ₈₈	$\Sigma^+\bar{p}K_S^0 + c.c.$	(1.53±0.12)	$\times 10^{-4}$		DESIG=105
Γ ₈₉	$\Sigma^0\bar{p}K^+ + c.c.$	(1.46±0.10)	$\times 10^{-4}$		DESIG=108
Γ ₉₀	$\Sigma^+\bar{\Sigma}^-$	(3.6 ± 0.7)	$\times 10^{-5}$		DESIG=49
Γ ₉₁	$\Sigma^+\bar{\Sigma}^- \eta$	(5.1 ± 1.4)	$\times 10^{-5}$		DESIG=122
Γ ₉₂	$\Sigma^-\bar{\Sigma}^+$	(5.7 ± 1.5)	$\times 10^{-5}$		DESIG=107
Γ ₉₃	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	< 9	$\times 10^{-5}$	CL=90%	DESIG=72
Γ ₉₄	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	< 5	$\times 10^{-5}$	CL=90%	DESIG=73
Γ ₉₅	$K^-\Lambda\bar{\Xi}^+ + c.c.$	(1.35±0.24)	$\times 10^{-4}$		DESIG=92
Γ ₉₆	$\Xi^0\bar{\Xi}^0$	(7.5 ± 1.3)	$\times 10^{-5}$		DESIG=50
Γ ₉₇	$\Xi^-\bar{\Xi}^+$	(6.0 ± 0.6)	$\times 10^{-5}$		DESIG=26
Γ ₉₈	$\Omega^-\bar{\Omega}^+$	(1.49±0.25)	$\times 10^{-5}$		DESIG=113
Γ ₉₉	$\pi^+\pi^- + K^+K^-$	< 2.1	$\times 10^{-3}$		DESIG=23
Γ ₁₀₀	$K_S^0\bar{K}_S^0$	< 6	$\times 10^{-5}$	CL=90%	DESIG=27
Γ ₁₀₁	$\eta_c\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=83

Radiative decays

Γ ₁₀₂	$\gamma J/\psi(1S)$	(34.3 ± 1.3) %	S=1.3	NODE=M055;CLUMP=B	DESIG=1
Γ ₁₀₃	$\gamma\rho^0$	(2.16±0.17)	$\times 10^{-4}$		DESIG=45
Γ ₁₀₄	$\gamma\omega$	(6.8 ± 0.8)	$\times 10^{-5}$		DESIG=46
Γ ₁₀₅	$\gamma\phi$	(2.4 ± 0.5)	$\times 10^{-5}$		DESIG=47
Γ ₁₀₆	$\gamma\gamma$	< 6.3	$\times 10^{-6}$	CL=90%	DESIG=4
Γ ₁₀₇	$e^+e^- J/\psi(1S)$	(3.46±0.24)	$\times 10^{-3}$		DESIG=100
Γ ₁₀₈	$\mu^+\mu^- J/\psi(1S)$	(2.33±0.29)	$\times 10^{-4}$		DESIG=103

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 88 branching ratios uses 255 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 393.1$ for 206 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{48}	4				
x_{59}	-1	0			
x_{73}	12	5	-1		
x_{102}	20	9	-25	23	
Γ	-9	-4	-60	-11	-31
	x_{19}	x_{48}	x_{59}	x_{73}	x_{102}

$\chi_{c1}(1P)$ PARTIAL WIDTHS

NODE=M055220

$\Gamma(e^+e^-)$					Γ_2
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.12^{+0.13}_{-0.08}	250	¹ ABLIKIM	22AF BES3	$e^+e^- \rightarrow \chi_{c1} \rightarrow \gamma J/\psi$	NODE=M055W1 NODE=M055W1
¹ Assuming $\Gamma(\chi_{c1} \rightarrow \gamma J/\psi) = 0.28$ MeV.					NODE=M055W1;LINKAGE=A

$\chi_{c1}(1P) \Gamma(i)\Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})$

NODE=M055223

$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$				$\Gamma_{59}\Gamma_{102}/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	NODE=M055G1 NODE=M055G1
21.9±0.8 OUR FIT				
21.4±0.9 OUR AVERAGE				
21.5±0.5±0.8	¹ ANDREOTTI	05A	E835	$p\bar{p} \rightarrow e^+e^-\gamma$
21.4±1.5±2.2	^{1,2} ARMSTRONG	92	E760	$p\bar{p} \rightarrow e^+e^-\gamma$
19.9 ^{+4.4} _{-4.0}	¹ BAGLIN	86B	SPEC	$p\bar{p} \rightarrow e^+e^-X$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

² Recalculated by ANDREOTTI 05A.

NODE=M055G;LINKAGE=7A
NODE=M055G;LINKAGE=AN

$\chi_{c1}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$

Γ_3/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
10.4 ± 1.6 OUR AVERAGE		Error includes scale factor of 4.6.		
10.92 ± 0.23 ± 0.30	84K	¹ ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
5.4 ± 0.7 ± 0.9		² BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$
16.0 ± 5.9 ± 0.8		² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055225

NODE=M055305

NODE=M055R6
NODE=M055R6

¹ ABLIKIM 22Q reports $(1.092 \pm 0.004 \pm 0.035) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R6;LINKAGE=A

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R;LINKAGE=X2

$\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$

Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.6 ± 2.6 OUR EVALUATION		Treating systematic error as correlated.		
8 ± 4 OUR AVERAGE		Error includes scale factor of 1.5.		
4.6 ± 2.1 ± 2.6		¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.5 ± 4.2 ± 0.6		¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R4
NODE=M055R4

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.85 ± 0.26 ± 0.19	670	² ABLIKIM	24BT BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R4;LINKAGE=X2

² ABLIKIM 24BT reports $(0.685 \pm 0.001 \pm 0.031) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R4;LINKAGE=A

$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$

Γ_5/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.19 ± 0.15 ± 0.03	604.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R35
NODE=M055R35

¹ HE 08B reports $1.28 \pm 0.06 \pm 0.15 \pm 0.08 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R35;LINKAGE=HE

$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$

Γ_6/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.45 ± 0.24 ± 0.04	712.3	^{1,2} HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R36
NODE=M055R36

¹ HE 08B reports $1.56 \pm 0.13 \pm 0.22 \pm 0.10 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R36;LINKAGE=HE

² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M055R36;LINKAGE=OC

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$

Γ_7/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.9 ± 3.5	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R8
NODE=M055R8

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R;LINKAGE=T

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±0.8±0.1	608	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R44
 NODE=M055R44

¹ ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R44;LINKAGE=AB

 $\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.5±1.0 OUR EVALUATION	Treating systematic error as correlated.		
4.5±0.9 OUR AVERAGE			

NODE=M055R5
 NODE=M055R5

→ UNCHECKED ←

4.2±0.4±0.9

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$

7.3±3.0±0.4

¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R5;LINKAGE=X2

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.12±0.27±0.03	45.1	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R37
 NODE=M055R37

¹ HE 08B reports $(0.12 \pm 0.02 \pm 0.02 \pm 0.01) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R37;LINKAGE=HE

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.46±0.12±1.29	12k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R00
 NODE=M055R00

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R00;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.52±0.11±0.79	5.1k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R60
 NODE=M055R60

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R60;LINKAGE=A

 $\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.86±0.13±0.02	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R39
 NODE=M055R39

¹ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R39;LINKAGE=HE

 $\Gamma(\rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.50±0.12±0.01	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R40
 NODE=M055R40

¹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R40;LINKAGE=HE

 $\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.23±0.06±0.01	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R41
 NODE=M055R41

¹ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R41;LINKAGE=HE

$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.112±0.034±0.003	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R42
NODE=M055R42

¹ HE 08B reports $0.12 \pm 0.03 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R42;LINKAGE=HE

 $\Gamma(\pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.9±2.9±0.2	19.8±7.7	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

NODE=M055R05
NODE=M055R05

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05;LINKAGE=AB

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ±1.0 ±0.1		¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R25
NODE=M055R25

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.30±0.05	8690	² ABLIKIM	24BWBES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ ATHAR 07 reports $(0.34 \pm 0.10 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R25;LINKAGE=AT

² No systematic error reported.

NODE=M055R25;LINKAGE=A

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.03±0.15 OUR AVERAGE				

NODE=M055R09
NODE=M055R09

1.04±0.13±0.10	262	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
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0.98±0.37±0.03	22	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ AAIJ 23AH reports $(1.04 \pm 0.13 \pm 0.04 \pm 0.09) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R09;LINKAGE=B

² ABLIKIM 06R reports $(1.1 \pm 0.4 \pm 0.1) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R09;LINKAGE=AB

 $\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.21±0.23 OUR AVERAGE				

NODE=M055R10
NODE=M055R10

1.18±0.17±0.17	288	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
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1.43±0.65±0.04	27	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ AAIJ 23AH reports $(1.18 \pm 0.17 \pm 0.14 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R10;LINKAGE=C

² ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R10;LINKAGE=AB

 $\Gamma(K_j^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻⁴	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R12
NODE=M055R12

¹ ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_j^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R12;LINKAGE=AB

$$\Gamma(K_S^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-3}$	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R13
NODE=M055R13

¹ ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R13;LINKAGE=AB

$$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$1.81 \pm 0.24 \pm 0.05$	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R20
NODE=M055R20

¹ ATHAR 07 reports $(1.95 \pm 0.16 \pm 0.23) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R20;LINKAGE=AT

$$\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.62 ± 0.24 OUR AVERAGE				

NODE=M055R08
NODE=M055R08

$4.58 \pm 0.23 \pm 0.13$		^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
$4.7 \pm 0.5 \pm 0.1$		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
$5.3 \pm 0.9 \pm 0.1$	222	⁴ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.67 \pm 0.03 \pm 0.23 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=A
NODE=M055R08;LINKAGE=B

³ ATHAR 07 reports $(5.0 \pm 0.3 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=AT

⁴ ABLIKIM 06R reports $(5.9 \pm 0.7 \pm 0.8) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=AB

$$\Gamma(a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.4 OUR AVERAGE				Error includes scale factor of 2.1.

NODE=M055R15
NODE=M055R15

$3.33 \pm 0.19 \pm 0.09$		^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
$1.79 \pm 0.63 \pm 0.05$	58	³ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(3.40 \pm 0.03 \pm 0.19 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R15;LINKAGE=A
NODE=M055R15;LINKAGE=B

³ ABLIKIM 06R reports $(2.0 \pm 0.5 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R15;LINKAGE=AB

$$\Gamma(a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$0.176 \pm 0.023 \pm 0.005$	^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R72
NODE=M055R72

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.18 \pm 0.01 \pm 0.02 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R72;LINKAGE=A
NODE=M055R72;LINKAGE=B

$\Gamma(a_2(1700)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.6±0.7±0.1	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R75
NODE=M055R75

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.7 \pm 0.4 \pm 0.6 \pm 0.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1700)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R75;LINKAGE=A
NODE=M055R75;LINKAGE=B

 $\Gamma(f_2(1270)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.5±0.6±0.1	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R73
NODE=M055R73

OCCUR=2

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.36 \pm 0.01 \pm 0.06 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R73;LINKAGE=A
NODE=M055R73;LINKAGE=D

 $\Gamma(f_4(2050)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.5±0.9±0.1	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R74
NODE=M055R74

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(2.6 \pm 0.4 \pm 0.8 \pm 0.1) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_4(2050)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R74;LINKAGE=A
NODE=M055R74;LINKAGE=B

 $\Gamma(\pi_1(1400)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5 × 10⁻⁵	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R76
NODE=M055R76

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 4.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1400)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R76;LINKAGE=A
NODE=M055R76;LINKAGE=B

 $\Gamma(\pi_1(1600)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.5 × 10⁻⁵	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R77
NODE=M055R77

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 1.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1600)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R77;LINKAGE=A
NODE=M055R77;LINKAGE=B

 $\Gamma(\pi_1(2015)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻⁶	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M055R78
NODE=M055R78

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(2015)^+\pi^-\text{ + c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R78;LINKAGE=A
NODE=M055R78;LINKAGE=B

 $\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.67±0.11 OUR AVERAGE				
0.63±0.11±0.02		1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$
2.7 ±0.8 ±0.1	53	³ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R16
NODE=M055R16

¹ABLIKIM 17K reports $(6.4 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R16;LINKAGE=B

²From an amplitude analysis using an isobar model.

NODE=M055R16;LINKAGE=D

³ABLIKIM 06R reports $(3.0 \pm 0.7 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R16;LINKAGE=C

$\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.2±0.4±0.1	¹ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R28
NODE=M055R28

¹ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R28;LINKAGE=AT

$\Gamma(K^+K^-\eta'(958))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.75±0.87	310	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R64
NODE=M055R64

¹Derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.2 \pm 0.4)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

NODE=M055R64;LINKAGE=A

$\Gamma(K_2^*(1430)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.61±0.19±0.24	351	¹ AAIJ	23AH	LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$

NODE=M055R93
NODE=M055R93

¹AAIJ 23AH reports $(1.61 \pm 0.19 \pm 0.19 \pm 0.14) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_2^*(1430)^+K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R93;LINKAGE=B

$\Gamma(K_2^*(1430)\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.17±0.16±0.11	278	¹ AAIJ	23AH	LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$

NODE=M055R94
NODE=M055R94

¹AAIJ 23AH reports $(1.17 \pm 0.16 \pm 0.05 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_2^*(1430)\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R94;LINKAGE=B

$\Gamma(K_0^*(1430)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
6.41±0.57^{+2.09}_{-2.71}	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R65
NODE=M055R65

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R65;LINKAGE=A

$\Gamma(f_0(980)\eta'(958))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.65±0.47^{+1.32}_{-0.56}	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R66
NODE=M055R66

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R66;LINKAGE=A

$\Gamma(f_0(1710)\eta'(958))/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.71±0.22^{+0.68}_{-0.48}	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R67
NODE=M055R67

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R67;LINKAGE=A

$\Gamma(f_2'(1525)\eta'(958))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.92±0.23^{+0.55}_{-0.51}	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R68
NODE=M055R68

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R68;LINKAGE=A

$\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
0.35±0.09		ABLIKIM	18D BES3	$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

NODE=M055R18
NODE=M055R18

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 90 ¹ ABLIKIM 11D BES3 $\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

¹ ABLIKIM 11D reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R18;LINKAGE=BR

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
32±21	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R9
NODE=M055R9

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R9;LINKAGE=T

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.36±0.04	28.4 ± 5.5	^{1,2} ABLIKIM	04H BES	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M055R26
NODE=M055R26

¹ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R26;LINKAGE=AB

² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

NODE=M055R26;LINKAGE=AL

 $\Gamma(K^+ K^- K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4 × 10⁻⁴	90	3.2 ± 2.4	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

NODE=M055R06
NODE=M055R06

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 K_S^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R06;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0 K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.10±0.01	22	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$

NODE=M055R82
NODE=M055R82

¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (3.4 \pm 0.9 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M055R82;LINKAGE=A

 $\Gamma(K^+ K^- \phi) / \Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.15±0.01	17	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M055R07
NODE=M055R07

¹ ABLIKIM 06T reports $(0.46 \pm 0.16 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R07;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.27±0.28±0.46	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R69
NODE=M055R69

 $\Gamma(K^+ K^- \pi^0 \phi) / \Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.62±0.12±0.28	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R70
NODE=M055R70

 $\Gamma(\phi \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75±0.06±0.08	373	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R62
NODE=M055R62

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R62;LINKAGE=A

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7±0.7±0.2	597	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

NODE=M055R49
 NODE=M055R49

¹ ABLIKIM 11K reports $(6.0 \pm 0.3 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R49;LINKAGE=AL

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.78±0.04±0.08	628	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R61
 NODE=M055R61

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R61;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.27±0.04±0.01	105	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma$ hadrons

NODE=M055R50
 NODE=M055R50

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.21±0.06±0.01 15 ^{2,3} ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (2.67 \pm 0.31 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R50;LINKAGE=A

² ABLIKIM 11K reports $(0.22 \pm 0.06 \pm 0.02) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R50;LINKAGE=AL

³ Superseded by ABLIKIM 19J.

NODE=M055R50;LINKAGE=B

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.26±0.17±0.12	1529	^{1,2} ABLIKIM	23N BES3	$\psi(2S) \rightarrow \gamma$ hadrons

NODE=M055R51
 NODE=M055R51

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2 ± 0.5 ± 0.1 366 ³ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

² ABLIKIM 23N reports $(4.26 \pm 0.13 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R51;LINKAGE=C
 NODE=M055R51;LINKAGE=D

³ ABLIKIM 11K reports $(4.4 \pm 0.3 \pm 0.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R51;LINKAGE=AL

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0±0.5±0.1	83.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma\phi\phi\eta$

NODE=M055R85
 NODE=M055R85

¹ ABLIKIM 20B reports $(2.96 \pm 0.43 \pm 0.22) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R85;LINKAGE=A

 $\Gamma(\rho\bar{\rho}\pi^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.155±0.018 OUR AVERAGE			

NODE=M055R21
 NODE=M055R21

0.163±0.019±0.004

¹ ONYISI 10 CLE3 $\psi(2S) \rightarrow \gamma\rho\bar{\rho}X$

0.112±0.047±0.003

² ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.75 \pm 0.16 \pm 0.13 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R21;LINKAGE=ON

² ATHAR 07 reports $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R21;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ **Γ_{61}/Γ**

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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0.145 ± 0.024 ± 0.004		¹ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.15	90	² ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
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¹ ONYISI 10 reports $(1.56 \pm 0.22 \pm 0.14 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R27;LINKAGE=ON

² ATHAR 07 reports $< 0.16 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R27;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{62}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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0.212 ± 0.030 ± 0.006	¹ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
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¹ ONYISI 10 reports $(2.28 \pm 0.28 \pm 0.16 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R43
NODE=M055R43

NODE=M055R43;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{63}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.7 × 10⁻⁵	90	¹ ABLIKIM	11F	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$
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¹ ABLIKIM 11F reports $< 1.82 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R48
NODE=M055R48

NODE=M055R48;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{64}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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0.50 ± 0.19 OUR EVALUATION	Treating systematic error as correlated.		
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0.50 ± 0.19 OUR AVERAGE			
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0.46 ± 0.12 ± 0.15	¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma\chi_{c1}$
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1.08 ± 0.77 ± 0.05	¹ TANENBAUM	78	MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$
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¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R7
NODE=M055R7

→ UNCHECKED ←

NODE=M055R7;LINKAGE=X2

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ **Γ_{65}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<5 × 10⁻⁴	90	¹ HE	08B	CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
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¹ HE 08B reports $< 0.05 \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R38
NODE=M055R38

NODE=M055R38;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ **Γ_{66}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.27 ± 0.22 ± 0.04	82 ± 9	¹ ABLIKIM	11F	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$
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¹ ABLIKIM 11F reports $(1.35 \pm 0.15 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R45
NODE=M055R45

NODE=M055R45;LINKAGE=AB

$\Gamma(\rho\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R02
 NODE=M055R02

¹ Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma)$ (9.1 ± 0.6)%.

NODE=M055R;LINKAGE=AB

 $\Gamma(\rho\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8±0.5±0.1	1412	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-$

NODE=M055R56
 NODE=M055R56

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.37 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R56;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±0.5±0.1	1625	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+$

NODE=M055R57
 NODE=M055R57

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.38 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R57;LINKAGE=AL

 $\Gamma(\rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.3±1.1±0.3	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-\pi^0$

NODE=M055R58
 NODE=M055R58

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (1.00 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R58;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.1±1.1±0.3	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+\pi^0$

NODE=M055R59
 NODE=M055R59

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.98 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R59;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
29±5±1		105	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R01
 NODE=M055R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

<150	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
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¹ ABLIKIM 12I reports $(31.1 \pm 3.4 \pm 3.9) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R01;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma)$ (9.1 ± 0.6)%.

NODE=M055R01;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
25±6±1	13	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R19
 NODE=M055R19

¹ ABLIKIM 12I reports $(26.2 \pm 5.5 \pm 3.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R19;LINKAGE=AL

$\Gamma(\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-4}$	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Lambda} \pi^-$

¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R52
NODE=M055R52

NODE=M055R52;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Lambda} \pi^+$

¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R53
NODE=M055R53

NODE=M055R53;LINKAGE=AL

 $\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE				Error includes scale factor of 1.2.
$9.2^{+2.8}_{-2.4} \pm 0.4$	24	¹ LU	19	BELL $B^+ \rightarrow \bar{p} \Lambda K^+ K^+$
$4.2 \pm 0.4 \pm 0.1$	3k	^{2,3} ABLIKIM	13D	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
$3.1 \pm 0.9 \pm 0.1$		⁴ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R22
NODE=M055R22

NODE=M055R22;LINKAGE=A

¹ LU 19 reports $(9.15^{+2.63}_{-2.25} \pm 0.86) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(1P) K^+)]$ assuming $B(B^+ \rightarrow \chi_{c1}(1P) K^+) = (4.79 \pm 0.23) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \chi_{c1}(1P) K^+) = (4.74 \pm 0.22) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13D reports $(4.5 \pm 0.2 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

⁴ ATHAR 07 reports $(3.3 \pm 0.9 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R22;LINKAGE=AB

NODE=M055R22;LINKAGE=LB
NODE=M055R22;LINKAGE=AT $\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.66 \pm 0.16 \pm 0.05$	399	¹ ABLIKIM 21AV	BES3	$\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$

NODE=M055R89
NODE=M055R89

NODE=M055R89;LINKAGE=A

¹ ABLIKIM 21AV reports $(1.66 \pm 0.12 \pm 0.12) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0975 \pm 0.0024$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 0.7 \pm 0.1$	328	¹ ABLIKIM 19AU	BES3	$\psi(2S) \rightarrow \gamma K^* \bar{p} \Lambda$

NODE=M055R86
NODE=M055R86

NODE=M055R86;LINKAGE=F

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (4.8 \pm 0.5 \pm 0.4) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.71 \pm 0.44 \pm 0.05$	48 \pm 10	¹ ABLIKIM 11F	BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M055R46
NODE=M055R46

¹ ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R46;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-5}$	90	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M055R47
NODE=M055R47

¹ ABLIKIM 11F reports $< 1.00 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$.

NODE=M055R47;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.2 \pm 0.6 \pm 0.1$		103	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

NODE=M055R32
NODE=M055R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
<4	90	3.8 ± 2.5	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ = $(0.41 \pm 0.05 \pm 0.03) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R32;LINKAGE=B

² ABLIKIM 13H reports $< 0.62 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R32;LINKAGE=AB

³ NAIK 08 reports $< 0.44 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R32;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 0.6 \pm 0.1$		59	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M055R33
NODE=M055R33

• • • We do not use the following data for averages, fits, limits, etc. • • •

<8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<6	90	4.3 ± 2.3	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ = $(0.35 \pm 0.06 \pm 0.02) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R33;LINKAGE=B

² ABLIKIM 13H reports $< 0.87 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R33;LINKAGE=AB

³ NAIK 08 reports $< 0.65 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R33;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.1 \pm 1.4 \pm 0.1$	36	¹ ABLIKIM	24CA BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}(1P)$

NODE=M055P01
NODE=M055P01

¹ ABLIKIM 24CA reports $(5.10 \pm 1.21 \pm 0.67) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055P01;LINKAGE=A

$\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.7 \pm 1.5 \pm 0.2$	214	¹ ABLIKIM	20I BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

NODE=M055R87
NODE=M055R87

¹ ABLIKIM 20i reports $(5.7 \pm 1.4 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R87;LINKAGE=A

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-5}$	90	¹ ABLIKIM	12i	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M055R54
NODE=M055R54

¹ ABLIKIM 12i reports $< 10 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R54;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5 \times 10^{-5}$	90	¹ ABLIKIM	12i	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M055R55
NODE=M055R55

¹ ABLIKIM 12i reports $< 5.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R55;LINKAGE=AL

$\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.35 \pm 0.24 \pm 0.04$	49	¹ ABLIKIM	15i	BES3 $\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$

NODE=M055R71
NODE=M055R71

¹ ABLIKIM 15i reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $= (1.32 \pm 0.20 \pm 0.12) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R71;LINKAGE=A

$\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$7.5 \pm 1.2 \pm 0.2$		325	¹ ABLIKIM	220	BES3 $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$

NODE=M055R34
NODE=M055R34

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	1.7 ± 2.4	² NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$
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¹ ABLIKIM 220 reports $(0.75 \pm 0.11 \pm 0.06) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R34;LINKAGE=A

² NAIK 08 reports $< 0.60 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R34;LINKAGE=NA

$\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.60 ± 0.06 OUR AVERAGE					

NODE=M055R03
NODE=M055R03

$0.58 \pm 0.06 \pm 0.02$		692	¹ ABLIKIM	220	BES3 $\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$
$0.80 \pm 0.21 \pm 0.02$		16.4 ± 4.3	² NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3.4	90		³ ABLIKIM	06D	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ ABLIKIM 220 reports $(0.58 \pm 0.04 \pm 0.05) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R03;LINKAGE=A

² NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R03;LINKAGE=NA

³ Using $B(\psi(2S) \rightarrow \chi_{c1} \gamma) (9.1 \pm 0.6)\%$.

NODE=M055R03;LINKAGE=AB

$\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.49 ± 0.23 ± 0.10	277	ABLIKIM	23T BES3	$\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$

NODE=M055R91
 NODE=M055R91

 $[\Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-)]/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 21 × 10⁻⁴		¹ FELDMAN	77 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 38 × 10 ⁻⁴	90	¹ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R2
 NODE=M055R2

NODE=M055R2;LINKAGE=T

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{100}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 6 × 10⁻⁵	90	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ < 0.6×10^{-5} which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R04
 NODE=M055R04

NODE=M055R04;LINKAGE=AB

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2 × 10⁻³	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4.4 × 10 ⁻³	90	^{1,3} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

² Using the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.

³ Using the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.

NODE=M055R63
 NODE=M055R63

OCCUR=2

NODE=M055R63;LINKAGE=A

NODE=M055R63;LINKAGE=B

NODE=M055R63;LINKAGE=C

NODE=M055310

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$ Γ_{103}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
216 ± 17 OUR AVERAGE				

215 ± 22 ± 6	432 ± 25	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
217 ± 24 ± 6	186 ± 15	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

¹ ABLIKIM 11E reports $(228 \pm 13 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(243 \pm 19 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R29
 NODE=M055R29

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

 $\Gamma(\gamma \omega)/\Gamma_{\text{total}}$ Γ_{104}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
68 ± 8 OUR AVERAGE				

66 ± 9 ± 2	136 ± 14	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \omega$
74 ± 17 ± 2	39 ± 7	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \omega$

¹ ABLIKIM 11E reports $(69.7 \pm 7.2 \pm 6.6) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(83 \pm 15 \pm 12) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R30
 NODE=M055R30

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
24±5±1		43 ± 9	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$

NODE=M055R31
 NODE=M055R31

• • • We do not use the following data for averages, fits, limits, etc. • • •

<23 90 5.2 ± 3.1 ² BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

¹ ABLIKIM 11E reports $(25.8 \pm 5.2 \pm 2.3) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R31;LINKAGE=AB

² BENNETT 08A reports $< 26 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R31;LINKAGE=BE

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{106}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 6.3 × 10⁻⁶	90	ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow 3\gamma$

NODE=M055R3
 NODE=M055R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3.5 × 10⁻⁵ 90 ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow 3\gamma$
 <150 × 10⁻⁵ 90 ¹ YAMADA 77 DASP $e^+e^- \rightarrow 3\gamma$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R;LINKAGE=T1

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{107}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.65±0.23±0.10	1.9k	^{1,2} ABLIKIM	17I BES3	$\psi(2S) \rightarrow \gamma e^+e^- J/\psi$

NODE=M055R79
 NODE=M055R79

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ ABLIKIM 17I reports $(3.73 \pm 0.09 \pm 0.25) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow e^+e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R79;LINKAGE=B

² Not independent from other measurements reported by ABLIKIM 17I

NODE=M055R79;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ $\Gamma_{107}/\Gamma_{102}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
10.1±0.3±0.5	1.9k	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^- \gamma J/\psi$

NODE=M055R80
 NODE=M055R80

¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (351.8 \pm 1.0 \pm 12.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M055R80;LINKAGE=A

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$ $\Gamma_{108}/\Gamma_{107}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
6.73±0.51±0.50	222	ABLIKIM	19Z BES3	$\psi(2S) \rightarrow \gamma\chi_c \rightarrow \gamma(\mu^+\mu^- J/\psi)$

NODE=M055R84
 NODE=M055R84

 $\chi_{c1}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M055230

$$\Gamma(\chi_{c1}(1P) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.68±0.01±0.25	670	¹ ABLIKIM	24BT BES3	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R98
 NODE=M055R98

¹ Calculated by us. The value given here is derived from the value of $B(\chi_{c1} \rightarrow 2(\pi^+\pi^-))$ reported in ABLIKIM 24BT using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.75 \pm 0.24)\%$ [PDG 22].

NODE=M055R98;LINKAGE=A

$$\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
6.8±0.6 OUR FIT	Error includes scale factor of 1.1.		
7.2±0.6 OUR AVERAGE			

NODE=M055B16
 NODE=M055B16

7.3±0.5±0.5 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$
 7.0±0.5±0.9 ² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-) = (4.0 \pm 0.3 \pm 0.5) \times 10^{-3}$. We use $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.4) \times 10^{-2}$.

NODE=M055B16;LINKAGE=AT

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \frac{\Gamma_{19}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

19.6±1.6 OUR FIT Error includes scale factor of 1.1.

13.2±2.4±3.2 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

NODE=M055B17
NODE=M055B17

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{48}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

0.53±0.11 OUR FIT

0.61±0.11±0.08 54 ¹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$.

NODE=M055B14
NODE=M055B14

NODE=M055B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \frac{\Gamma_{48}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

1.52±0.31 OUR FIT

1.13±0.40±0.29 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B15
NODE=M055B15

NODE=M055B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow 3(K^+ K^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{52}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT

4.1±0.9±0.5 24.9±5.1 ¹ ABLIKIM 24P BES3 $e^+ e^- \rightarrow \psi(2S)$

¹ Systematic error derived by us, based on the text.

NODE=M055R96
NODE=M055R96

NODE=M055R96;LINKAGE=A

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{59}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

7.4±0.4 OUR FIT Error includes scale factor of 1.3.

7.8±0.6 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

7.9±0.4±0.3 453 ABLIKIM 13v BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$

8.2±0.7±0.4 141±13 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$

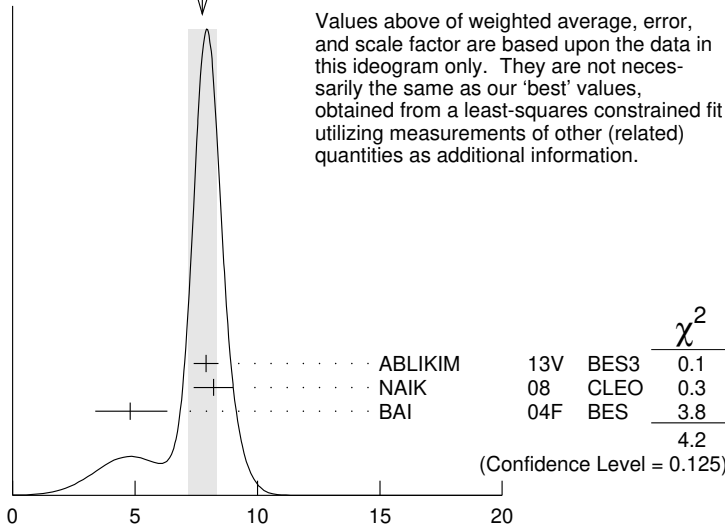
4.8^{+1.4}_{-1.3}±0.6 18.2^{+5.5}_{-4.9} BAI 04F BES $\psi(2S) \rightarrow \gamma \chi_{c1}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p\bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B6
NODE=M055B6

NODE=M055B6;LINKAGE=NA

WEIGHTED AVERAGE
7.8±0.6 (Error scaled by 1.4)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-6}\text{)}$$

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma_{59}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.13±0.13 OUR FIT			Error includes scale factor of 1.3.
1.1 ±1.0	¹ BAI	98i BES	$\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma p\bar{p}$

NODE=M055B1
NODE=M055B1

¹ Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B;LINKAGE=J2

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \times \Gamma_{68}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
4.05±0.24±0.39	396	ABLIKIM	24BX BES3	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R99
NODE=M055R99

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \times \Gamma_{73}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.9 OUR FIT				Error includes scale factor of 1.1.
12.3±0.9 OUR AVERAGE				Error includes scale factor of 1.2.
12.8±0.6±0.6	528	ABLIKIM	21L BES3	$\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+$
10.5±1.6±0.6	46	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

NODE=M055B10
NODE=M055B10

• • • We do not use the following data for averages, fits, limits, etc. • • •

11.2±1.0±0.9	136	^{2,3} ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
--------------	-----	------------------------	----------	---

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (11.6 \pm 1.8 \pm 0.7 \pm 0.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B10;LINKAGE=NA

² Superseded by ABLIKIM 21L

NODE=M055B10;LINKAGE=A

³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (12.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ from a measurement of $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c1})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.2 \pm 0.4)\%$.

NODE=M055B10;LINKAGE=AB

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma_{73}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.58±0.25 OUR FIT				Error includes scale factor of 1.1.
7.1 $^{+2.8}_{-2.4}$ ±1.3	$9.0^{+3.5}_{-3.1}$	¹ BAI	03E BES	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

NODE=M055B11
NODE=M055B11

¹ BAI 03E reports $[B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c1}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.52}_{-0.46} \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M055B11;LINKAGE=BA

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{78} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.72 \pm 1.34 \pm 0.65$	21	ABLIKIM	22AO BES3	$\psi(2S) \rightarrow \gamma p \pi^- \bar{p} \pi^+ \gamma \gamma$

NODE=M055R90
NODE=M055R90

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \omega) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{79} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.8 \pm 1.0 \pm 1.1$	202 ± 20	¹ ABLIKIM	24BE BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R97
NODE=M055R97

¹ Calculated by us. The authors report $B(\chi_{c1} \rightarrow \Lambda \bar{\Lambda} \omega)$ obtained from a product using PDG 22 value of $B(\psi(2S) \rightarrow \gamma \chi_{c1})$.

NODE=M055R97;LINKAGE=A

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{80} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.86 \pm 0.87 \pm 0.39$	51.6	ABLIKIM	24AC BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R95
NODE=M055R95

$$\Gamma(\chi_{c1}(1P) \rightarrow \bar{p} \Lambda(1520) K_S^0 \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{83} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.96^{+0.77}_{-0.74} \pm 0.50$	88	ABLIKIM	24BX BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055P00
NODE=M055P00

$$\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{88} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.49 \pm 0.09 \pm 0.07$	258	¹ ABLIKIM	19BB BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

NODE=M055B01
NODE=M055B01

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c1} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (1.53 \pm 0.10 \pm 0.08) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 18.

NODE=M055B01;LINKAGE=A

$$\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{89} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.42 \pm 0.07 \pm 0.06$	493	¹ ABLIKIM	20AE BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

NODE=M055R88
NODE=M055R88

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_{c1} \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (1.46 \pm 0.07 \pm 0.07) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}^0) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 20.

NODE=M055R88;LINKAGE=A

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J / \psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{102} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.34 ± 0.10	OUR FIT	Error includes scale factor of 1.7.		
3.24 ± 0.16	OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.		

NODE=M055B2
NODE=M055B2

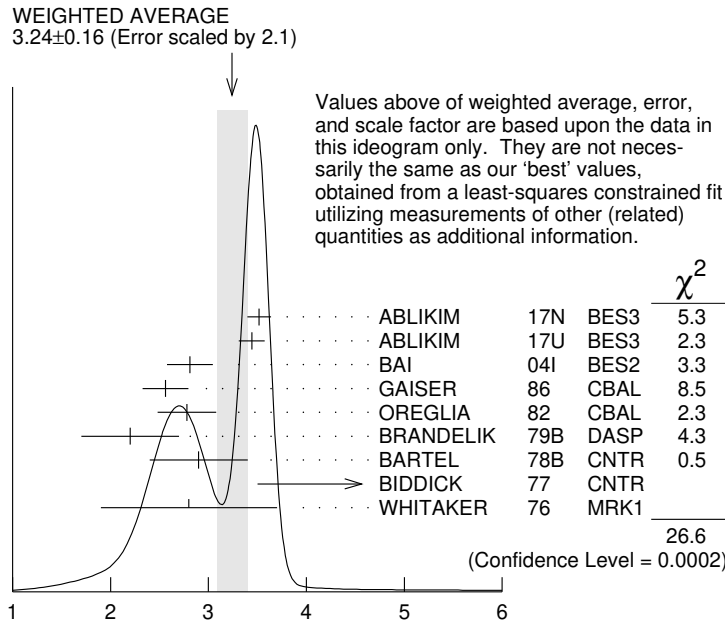
$3.518 \pm 0.010 \pm 0.120$	143k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J / \psi$
$3.442 \pm 0.010 \pm 0.132$	1.9M	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
$2.81 \pm 0.05 \pm 0.23$	13k	BAI	04I BES2	$\psi(2S) \rightarrow J / \psi \gamma \gamma$
$2.56 \pm 0.12 \pm 0.20$		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
2.78 ± 0.30		² OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.2 ± 0.5		³ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.9 ± 0.5		³ BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.0 ± 1.5		⁴ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
2.8 ± 0.9		² WHITAKER	76 MRK1	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.377 \pm 0.009 \pm 0.183$	142k	⁵ ABLIKIM	120 BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
$3.56 \pm 0.03 \pm 0.12$	24.9k	⁶ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
$3.44 \pm 0.06 \pm 0.13$	3.7k	⁷ ADAM	05A CLEO	Repl. by MENDEZ 08

- ¹ Uses $B(J/\psi \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.
- ² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.
- ³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.
- ⁴ Assumes isotropic gamma distribution.
- ⁵ Superseded by ABLIKIM 17N.
- ⁶ Not independent from other measurements of MENDEZ 08.
- ⁷ Not independent from other values reported by ADAM 05A.

NODE=M055B2;LINKAGE=A
 NODE=M055B;LINKAGE=3Q
 NODE=M055B;LINKAGE=2Q
 NODE=M055B;LINKAGE=EA
 NODE=M055B2;LINKAGE=B
 NODE=M055B2;LINKAGE=ME
 NODE=M055B;LINKAGE=AD



$$10^{-2}) \Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}} \text{ (units)}$$

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times \Gamma_{102} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.62 ± 0.29 OUR FIT				Error includes scale factor of 1.7. $[(9.63 \pm 0.29) \times 10^{-2}$ OUR 2024 FIT Scale factor = 1.7]
10.15 ± 0.28 OUR AVERAGE				
10.17 ± 0.07 ± 0.27	24.9k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.6 ± 0.3 ± 3.8	3k	¹ ABLIKIM	04B BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ± 2.1		² HIMEL	80 MRK2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
10.24 ± 0.17 ± 0.23	3.7k	³ ADAM	05A CLEO	Repl. by MENDEZ 08

NODE=M055B3
 NODE=M055B3
 NEW

- ¹ From a fit to the J/ψ recoil mass spectra.
- ² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c1}) \times B(\chi_{c1} \rightarrow \gamma J/\psi(1S))$ quoted in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.
- ³ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=AB
 NODE=M055B;LINKAGE=J3
 NODE=M055B3;LINKAGE=AD

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

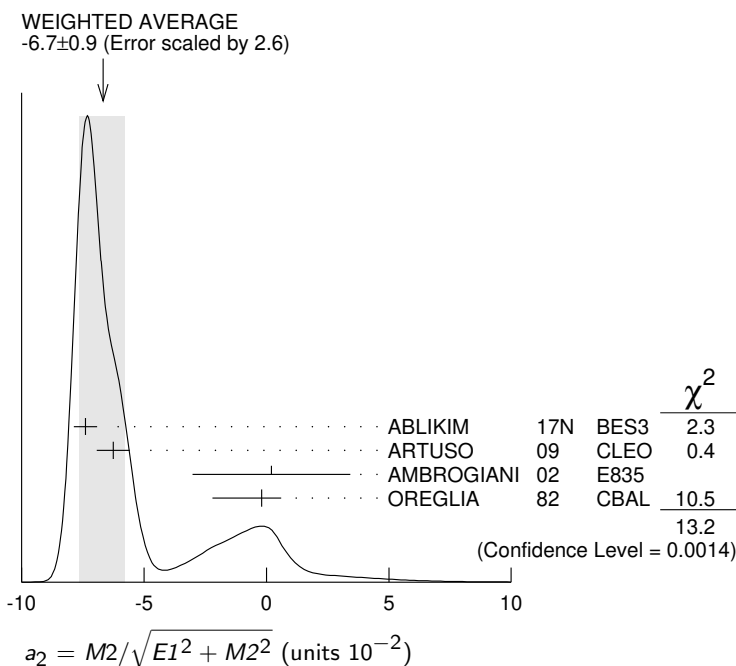
$a_2 = M2 / \sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055A1
 NODE=M055A1

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-6.7 ± 0.9 OUR AVERAGE				Error includes scale factor of 2.6. See the ideogram below.
-7.40 ± 0.33 ± 0.34	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
-6.26 ± 0.63 ± 0.24	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.2 ± 3.2 ± 0.4	2090	AMBROGIANI	02 E835	$p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi \gamma$
-0.2 ^{+0.8} _{-2.0}	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \chi_{c1} \gamma \rightarrow J/\psi \gamma \gamma$

¹ Correlated with b_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.

NODE=M055A1;LINKAGE=A



MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c1}(1S)$ RADIATIVE DECAY

NODE=M055250

$b_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055QB2
NODE=M055QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.4 OUR AVERAGE				
2.29 ± 0.39 ± 0.27	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.76 ± 0.73 ± 0.23	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
7.7 ^{+5.0} _{-4.5}	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Correlated with a_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.

NODE=M055QB2;LINKAGE=A

**MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS
 $\psi(2S) \rightarrow \gamma\chi_{c1}(1S)$ and $\chi_{c1} \rightarrow \gamma J/\psi(1S)$**

NODE=M055260

a_2/b_2 Magnetic quadrupole transition amplitude ratio

NODE=M055QAR
NODE=M055QAR

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-2.27 ^{+0.57}_{-0.99}	39k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Statistical and systematic errors combined. Not independent of $a_2(\chi_{c1})$ and $b_2(\chi_{c1})$ values from ARTUSO 09.

NODE=M055QAR;LINKAGE=AR

$\chi_{c1}(1P)$ REFERENCES

NODE=M055

ABLIKIM	24AC	PR D110 032016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62682
ABLIKIM	24BE	PR D110 032022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62904
ABLIKIM	24BT	PR D110 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63025
ABLIKIM	24BW	PR D110 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63028
ABLIKIM	24BX	PR D110 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63029
ABLIKIM	24CA	PR D110 112013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63032
ABLIKIM	24P	PR D109 072016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62667
AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	23N	JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM	23T	PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
ABLIKIM	22AF	PRL 129 122001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61878
ABLIKIM	22AO	PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM	22O	JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AV	JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026
ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837

LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)	REFID=59614
ABLIKIM	18D	PRL 121 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58849
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
AAIJ	17BI	PRL 119 221801	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58278
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57953
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16715
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48552
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	86B	PL B172 455	C. Baglin	(LAPP, CERN, GENO, LYON, OSLO+)	REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
TANENBAUM	75	PRL 35 1323	W.M. Tanenbaum <i>et al.</i>	(LBL, SLAC)	REFID=22106

$h_c(1P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Quantum numbers are quark model prediction, $C = -$ established by $\eta_c \gamma$ decay.

NODE=M144

NODE=M144

 $h_c(1P)$ MASS

NODE=M144M

NODE=M144M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3525.37±0.14 OUR AVERAGE		Error includes scale factor of 1.2.		
3525.32±0.06±0.15	23k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons; $\pi^0 \gamma(\eta_c)$
3525.20±0.18±0.12	1282	¹ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3525.8 ±0.2 ±0.2	13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3525.31±0.11±0.14	832	^{2,3} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
3525.40±0.13±0.18	3679	² ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
3525.6 ±0.5	92	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2(\pi^+ \pi^- \pi^0)$
3524.4 ±0.6 ±0.4	168	⁴ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3527 ±8	42	ANTONIAZZI	94 E705	$300 \pi^\pm, pLi \rightarrow$ $J/\psi \pi^0 X$
3526.28±0.18±0.19	59	⁵ ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$
3525.4 ±0.8 ±0.4	5	BAGLIN	86 SPEC	$\bar{p}p \rightarrow J/\psi X$

¹ Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

² Superseded by ABLIKIM 22AQ

³ With floating width.

⁴ Superseded by DOBBS 08A.

⁵ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M;LINKAGE=DO

NODE=M144M;LINKAGE=A

NODE=M144M;LINKAGE=AB

NODE=M144M;LINKAGE=RO

NODE=M144M;LINKAGE=NW

 $h_c(1P)$ WIDTH

NODE=M144W

NODE=M144W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.78^{+0.27}_{-0.24}±0.12		23k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons; $\pi^0 \gamma(\eta_c)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.70±0.28±0.22		832	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
< 1.44	90	3679	³ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
< 1		13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
< 1.1	90	59	ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$

¹ Superseded by ABLIKIM 22AQ

² With floating mass.

³ The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W;LINKAGE=A

NODE=M144W;LINKAGE=AL

NODE=M144W;LINKAGE=AB

 $h_c(1P)$ DECAY MODES

NODE=M144215;NODE=M144

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S)\pi^0$	< 5	$\times 10^{-4}$ 90%
Γ_2 $J/\psi(1S)\pi\pi$	< 9	$\times 10^{-5}$ 90%
Γ_3 $J/\psi(1S)\pi^+\pi^-$	< 9	$\times 10^{-4}$ 90%
Γ_4 $p\bar{p}$	< 4	$\times 10^{-5}$ 90%
Γ_5 $p\bar{p}\pi^0$	< 8	$\times 10^{-4}$ 90%
Γ_6 $p\bar{p}\pi^+\pi^-$	(3.3 ±0.6)	$\times 10^{-3}$ 90%
Γ_7 $p\bar{p}\pi^0\pi^0$	< 6	$\times 10^{-4}$ 90%
Γ_8 $p\bar{p}\pi^+\pi^-\pi^0$	(4.4 ±1.3)	$\times 10^{-3}$ 90%
Γ_9 $p\bar{p}\eta$	(7.4 ±2.2)	$\times 10^{-4}$ 90%
Γ_{10} $\pi^+\pi^-\pi^0$	(1.57±0.13)	$\times 10^{-3}$ 90%
Γ_{11} $\pi^+\pi^-\eta$	< 5	$\times 10^{-4}$ 90%
Γ_{12} $\pi^+\pi^-\pi^0\eta$	(8.3 ±2.4)	$\times 10^{-3}$ 90%
Γ_{13} $2\pi^+2\pi^-\pi^0\eta$	(7.2 ±1.7)	$\times 10^{-3}$ 90%

DESIG=1

DESIG=2

DESIG=10

DESIG=3

DESIG=24

DESIG=11

DESIG=13

DESIG=25

DESIG=23

DESIG=5

DESIG=31

DESIG=14

DESIG=29

Γ_{14}	$2\pi^+2\pi^-\pi^0$	$(9.4 \pm 1.7) \times 10^{-3}$		DESIG=6
Γ_{15}	$2\pi^+2\pi^-\eta$	$< 6 \times 10^{-4}$	90%	DESIG=30
Γ_{16}	$3\pi^+3\pi^-\pi^0$	$(9.1 \pm 1.5) \times 10^{-3}$		DESIG=7
Γ_{17}	$2\pi^+2\pi^-\omega$	$(3.9 \pm 1.0) \times 10^{-3}$		DESIG=28
Γ_{18}	$K^+K^-\pi^+\pi^-$	$< 7 \times 10^{-4}$	90%	DESIG=12
Γ_{19}	$K^+K^-\pi^+\pi^-\pi^0$	$(3.8 \pm 0.8) \times 10^{-3}$		DESIG=15
Γ_{20}	$K^+K^-\pi^+\pi^-\eta$	$< 2.7 \times 10^{-3}$	90%	DESIG=16
Γ_{21}	$K^+K^-\pi^0$	$(3.8 \pm 0.9) \times 10^{-4}$		DESIG=17
Γ_{22}	$K^+K^-\pi^0\eta$	$< 2.4 \times 10^{-3}$	90%	DESIG=18
Γ_{23}	$K^+K^-\eta$	$(3.6 \pm 1.2) \times 10^{-4}$		DESIG=19
Γ_{24}	$2K^+2K^-\pi^0$	$< 2.8 \times 10^{-4}$	90%	DESIG=20
Γ_{25}	$K_S^0 K^\pm \pi^\mp$	$(7.1 \pm 1.9) \times 10^{-4}$		DESIG=21
Γ_{26}	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-3}$		DESIG=22

Radiative decays

Γ_{27}	$\gamma\eta$	$(3.8 \pm 0.6) \times 10^{-4}$		NODE=M144;CLUMP=R
Γ_{28}	$\gamma\eta'(958)$	$(1.41 \pm 0.15) \times 10^{-3}$		DESIG=9
Γ_{29}	$\gamma\pi^0$	$< 5 \times 10^{-5}$		DESIG=8
Γ_{30}	$\gamma\eta_c(1S)$	$(60 \pm 4) \%$		DESIG=32
Γ_{31}	$e^+e^-\eta_c(1S)$	$(3.5 \pm 0.7) \times 10^{-3}$		DESIG=4
				DESIG=33

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and B^\pm with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

$h_c(1P)$ PARTIAL WIDTHS

$$h_c(1P) \Gamma(i) \Gamma(\bar{p}p) / \Gamma(\text{total})$$

$$\Gamma(\gamma\eta_c(1S)) \times \Gamma(p\bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{30} \Gamma_4 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
12.0 ± 4.5	13	¹ ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$

••• We do not use the following data for averages, fits, limits, etc. •••

¹ Assuming $\Gamma = 1$ MeV.

$h_c(1P)$ BRANCHING RATIOS

$$\Gamma(J/\psi(1S)\pi^0) / \Gamma(\gamma\eta_c(1S)) \quad \Gamma_1 / \Gamma_{30}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9 \times 10^{-4}$	90	¹ ABLIKIM	22N BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ ABLIKIM 22N reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^0) / \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))] / [B(\eta_c \rightarrow K^+K^-\pi^0)] < 7.5 \times 10^{-2}$ which we multiply by our best value $B(\eta_c \rightarrow K^+K^-\pi^0) = 1/6 B(\eta_c(1S) \rightarrow K\bar{K}\pi) = 1/6 (7.1 \times 10^{-2})$.

$$\Gamma(J/\psi(1S)\pi\pi) / \Gamma(J/\psi(1S)\pi^0) \quad \Gamma_2 / \Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.18	90	ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi\pi^0$

$$\Gamma(J/\psi(1S)\pi^+\pi^-) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9 \times 10^{-4}$ (CL = 90%)				$[< 2.7 \times 10^{-3}$ (CL = 90%) OUR 2024 BEST LIMIT]
$< 9 \times 10^{-4}$	90	¹ ABLIKIM	24BY BES3	$\psi(2S) \rightarrow \pi^0\pi^+\pi^- J/\psi$

••• We do not use the following data for averages, fits, limits, etc. •••

$< 2.7 \times 10^{-3}$ 90 ² ABLIKIM 18M BES3 $\psi(2S) \rightarrow \pi^0\pi^+\pi^- J/\psi$

¹ ABLIKIM 24BY reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^+\pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 6.7 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

² ABLIKIM 18M reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^+\pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.0 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144220

NODE=M144223

NODE=M144G1

NODE=M144G1

NODE=M144G1;LINKAGE=AN

NODE=M144225

NODE=M144R24

NODE=M144R24

NODE=M144R24;LINKAGE=B

NODE=M144R1

NODE=M144R1

NODE=M144R07

NODE=M144R07

OCCUR=2

NODE=M144R07;LINKAGE=C

NODE=M144R07;LINKAGE=B

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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 $<4 \times 10^{-5}$ (CL = 90%) [$<1.7 \times 10^{-4}$ (CL = 90%) OUR 2024 BEST LIMIT] $<4 \times 10^{-5}$ 90 ¹ ABLIKIM 24R BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 24R reports $[\Gamma(h_c(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 3.22 \times 10^{-8}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.NODE=M144R20
NODE=M144R20

NODE=M144R20;LINKAGE=B

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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 $<8 \times 10^{-4}$ 90 ¹ ABLIKIM 22M BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 5.67 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.NODE=M144R22
NODE=M144R22

NODE=M144R22;LINKAGE=A

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $3.3 \pm 0.5 \pm 0.2$ 230 ¹ ABLIKIM 19AG BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.49 \pm 0.27 \pm 0.28) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M144R08
NODE=M144R08

NODE=M144R08;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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 $<6 \times 10^{-4}$ 90 12 ¹ ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.4 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.NODE=M144R10
NODE=M144R10

NODE=M144R10;LINKAGE=A

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $4.4 \pm 1.2 \pm 0.3$ 86 ¹ ABLIKIM 22M BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (3.30 \pm 0.71 \pm 0.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M144R23
NODE=M144R23

NODE=M144R23;LINKAGE=A

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $7.4 \pm 2.1 \pm 0.5$ 20 ¹ ABLIKIM 22M BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ ¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (5.51 \pm 1.50 \pm 0.46) \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M144R21
NODE=M144R21

NODE=M144R21;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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1.57 ± 0.13 OUR AVERAGE [(1.9 ± 0.5) × 10⁻³ OUR 2024 AVERAGE]**1.57 ± 0.06 ± 0.11** 472 ¹ ABLIKIM 24BF BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1.9 ± 0.5 ± 0.1 101 ^{2,3} ABLIKIM 19AG BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$ <2.6 90 ⁴ ADAMS 09 CLEO $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$ ¹ ABLIKIM 24BF reports $(1.36 \pm 0.16 \pm 0.14) \times 10^{-3}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, which we rescale to our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (1.38 \pm 0.35 \pm 0.17) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Superseded by ABLIKIM 24BF.⁴ ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 0.19 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.NODE=M144R01
NODE=M144R01

NEW

NODE=M144R01;LINKAGE=B

NODE=M144R01;LINKAGE=A

NODE=M144R01;LINKAGE=C
NODE=M144R01;LINKAGE=AD

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<5 \times 10^{-4}$	90	44.5	1 ABLIKIM	24BF BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$

NODE=M144R28
NODE=M144R28

¹ ABLIKIM 24BF reports $< 4.0 \times 10^{-4}$ from a measurement of $[\Gamma(h_C(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, which we rescale to our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R28;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0\eta)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.3 \pm 2.3 \pm 0.6$	35	1 ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$

NODE=M144R11
NODE=M144R11

¹ ABLIKIM 20AH reports $[\Gamma(h_C(1P) \rightarrow \pi^+\pi^-\pi^0\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] = (6.2 \pm 1.6 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R11;LINKAGE=A

 $\Gamma(2\pi^+2\pi^-\pi^0\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$7.2 \pm 1.7 \pm 0.5$	1 ABLIKIM	24R BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$

NODE=M144R26
NODE=M144R26

¹ ABLIKIM 24R reports $[\Gamma(h_C(1P) \rightarrow 2\pi^+2\pi^-\pi^0\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] = (5.33 \pm 1.10 \pm 0.56) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R26;LINKAGE=A

 $\Gamma(2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.94 ± 0.17 OUR AVERAGE				

NODE=M144R02
NODE=M144R02

$0.86 \pm 0.16 \pm 0.06$	254	1 ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$
$2.5^{+0.9}_{-0.7} \pm 0.2$	92	2 ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_C$

¹ ABLIKIM 19AG reports $[\Gamma(h_C(1P) \rightarrow 2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] = (6.40 \pm 0.81 \pm 0.87) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=A

² ADAMS 09 reports $[\Gamma(h_C(1P) \rightarrow 2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] = (1.88^{+0.48+0.47}_{-0.45-0.30}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=AD

 $\Gamma(2\pi^+2\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-4}$	90	1 ABLIKIM	24R BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$

NODE=M144R27
NODE=M144R27

¹ ABLIKIM 24R reports $[\Gamma(h_C(1P) \rightarrow 2\pi^+2\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] < 4.53 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R27;LINKAGE=A

 $\Gamma(3\pi^+3\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
$9.1 \pm 1.3 \pm 0.6$		1 ABLIKIM	24R BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$

NODE=M144R03
NODE=M144R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10	90	2 ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_C(1P)$
<34	90	3 ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_C$

OCCUR=3

¹ ABLIKIM 24R reports $[\Gamma(h_C(1P) \rightarrow 3\pi^+3\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] = (6.79 \pm 0.83 \pm 0.56) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R03;LINKAGE=H

² ABLIKIM 19AG reports $[\Gamma(h_C(1P) \rightarrow 3\pi^+3\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] < 7.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = 7.4 \times 10^{-4}$. Superseded by ABLIKIM 24R.

NODE=M144R03;LINKAGE=A

³ ADAMS 09 reports $[\Gamma(h_C(1P) \rightarrow 3\pi^+3\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_C(1P)\pi^0)] < 2.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_C(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R03;LINKAGE=AD

$\Gamma(2\pi^+ 2\pi^- \omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID TECN COMMENT

3.9±0.9±0.3¹ ABLIKIM 24R BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 24R reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+ 2\pi^- \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.93 \pm 0.63 \pm 0.26) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{17}/Γ NODE=M144R25
NODE=M144R25

NODE=M144R25;LINKAGE=A

 $\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE CL%

DOCUMENT ID TECN COMMENT

<7 × 10⁻⁴

90

¹ ABLIKIM 19AG BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 0.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

 Γ_{18}/Γ NODE=M144R09
NODE=M144R09

NODE=M144R09;LINKAGE=A

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID TECN COMMENT

3.8±0.8±0.3

80

¹ ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.8 \pm 0.5 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{19}/Γ NODE=M144R12
NODE=M144R12

NODE=M144R12;LINKAGE=A

 $\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$

VALUE CL% EVTS

DOCUMENT ID TECN COMMENT

<2.7 × 10⁻³

90 24

¹ ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.0 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

 Γ_{20}/Γ NODE=M144R13
NODE=M144R13

NODE=M144R13;LINKAGE=A

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID TECN COMMENT

3.8±0.9±0.3

62

¹ ABLIKIM 24BF BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6

90 20

^{2,3} ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 24BF reports $(3.26 \pm 0.84 \pm 0.36) \times 10^{-4}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, which we rescale to our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Significance 3.5 σ .

² ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.8 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

³ Superseded by ABLIKIM 24BF.

 Γ_{21}/Γ NODE=M144R14
NODE=M144R14

NODE=M144R14;LINKAGE=B

NODE=M144R14;LINKAGE=A

NODE=M144R14;LINKAGE=C

 $\Gamma(K^+ K^- \pi^0 \eta)/\Gamma_{\text{total}}$

VALUE CL% EVTS

DOCUMENT ID TECN COMMENT

<2.4 × 10⁻³

90 20

¹ ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^0 \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 1.8 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

 Γ_{22}/Γ NODE=M144R15
NODE=M144R15

NODE=M144R15;LINKAGE=A

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID TECN COMMENT

3.6±1.2±0.3

32

¹ ABLIKIM 24BF BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10

90 18

^{2,3} ABLIKIM 20AH BES3 $\psi(2S) \rightarrow \pi^0 h_c(1P)$

¹ ABLIKIM 24BF reports $(3.13 \pm 1.08 \pm 0.38) \times 10^{-4}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (8.6 \pm 1.3) \times 10^{-4}$, which we rescale to our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Significance 3.3 σ .

² ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 7.5 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

³ Superseded by ABLIKIM 24BF.

 Γ_{23}/Γ NODE=M144R16
NODE=M144R16

NODE=M144R16;LINKAGE=B

NODE=M144R16;LINKAGE=A

NODE=M144R16;LINKAGE=C

$\Gamma(2K^+2K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-4}$	90	11	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R17
 NODE=M144R17

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow 2K^+2K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.1 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R17;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
$7.1 \pm 1.8 \pm 0.5$		¹ ABLIKIM	24Y BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R18
 NODE=M144R18

••• We do not use the following data for averages, fits, limits, etc. •••

<6	90	^{2,3} ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
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¹ ABLIKIM 24Y reports $[\Gamma(h_c(1P) \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (5.3 \pm 1.3 \pm 0.4) \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R18;LINKAGE=B

² ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.8 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R18;LINKAGE=A

³ Superseded by ABLIKIM 24Y.

NODE=M144R18;LINKAGE=C

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2 \pm 1.0 \pm 0.2$	41	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R19
 NODE=M144R19

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.4 \pm 0.7 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R19;LINKAGE=A

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.6 OUR AVERAGE				

NODE=M144R06
 NODE=M144R06
 NEW

$[(4.7 \pm 2.1) \times 10^{-4}$ OUR 2024 AVERAGE]

$3.8 \pm 0.6 \pm 0.3$		¹ ABLIKIM	24BJ BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
$4.7 \pm 1.5 \pm 1.4$	18	ABLIKIM	16I BES3	$\psi(2S) \rightarrow \pi^0 \gamma\eta$

¹ ABLIKIM 24BJ reports $(3.77 \pm 0.55 \pm 0.29) \times 10^{-4}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow \gamma\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$.

NODE=M144R06;LINKAGE=A

 $\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.41 ± 0.15 OUR AVERAGE				

NODE=M144R00
 NODE=M144R00
 NEW

$[(1.5 \pm 0.4) \times 10^{-3}$ OUR 2024 AVERAGE]

$1.40 \pm 0.11 \pm 0.11$		¹ ABLIKIM	24BJ BES3	$\psi(2S) \rightarrow \pi^0 \gamma\eta'$
$1.52 \pm 0.27 \pm 0.29$	44	ABLIKIM	16I BES3	$\psi(2S) \rightarrow \pi^0 \gamma\eta'(958)$

¹ ABLIKIM 24BJ reports $(1.40 \pm 0.11 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow \gamma\eta'(958))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$.

NODE=M144R00;LINKAGE=A

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$<5 \times 10^{-5}$	¹ ABLIKIM	24BJ BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R29
 NODE=M144R29

¹ ABLIKIM 24BJ reports $< 5.0 \times 10^{-5}$ from a measurement of $[\Gamma(h_c(1P) \rightarrow \gamma\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)]$ assuming $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$.

NODE=M144R29;LINKAGE=A

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
60 ± 4 OUR FIT				

NODE=M144R2
 NODE=M144R2

57 ± 5 OUR AVERAGE

$57 \pm 4 \pm 4$	23k	¹ ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0 \text{ hadrons};$ $\pi^0 \gamma(\eta_c)$
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OCCUR=2

$56 \pm 6 \pm 4$		² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$62 \pm 9 \pm 4$	3679	^{3,4} ABLIKIM	10B	BES3	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
$56 \pm 7 \pm 4$	1282	⁵ DOBBS	08A	CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
$54 \pm 14 \pm 4$	168	⁶ ROSNER	05	CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

¹ ABLIKIM 22AQ reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.22^{+0.27}_{-0.26} \pm 0.19) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=C

² Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DB

³ ABLIKIM 10B reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.58 \pm 0.40 \pm 0.50) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=A

⁴ Superseded by ABLIKIM 22AQ

NODE=M144R2;LINKAGE=B

⁵ DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DO

⁶ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=RO

$\Gamma(e^+ e^- \eta_c(1S))/\Gamma(\gamma \eta_c(1S))$

Γ_{31}/Γ_{30}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.9 \pm 1.0 \pm 0.4$	961	¹ ABLIKIM	24CC BES3	$\psi(3686) \rightarrow \pi^0 h_c$, $e^+ e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M144R30
NODE=M144R30

¹ Average between $\pi^0 h_c (4.6 \pm 1.2 \pm 0.5) \times 10^{-3}$ and $\pi^+ \pi^- h_c (8.9 \pm 1.8 \pm 0.9) \times 10^{-3}$.

NODE=M144R30;LINKAGE=A

$h_c(1P)$ REFERENCES

ABLIKIM	24BF	PR D110 032023	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62905
ABLIKIM	24BJ	JHEP 2408 180	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62945
ABLIKIM	24BY	PR D110 112010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63030
ABLIKIM	24CC	PR D110 L111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63034
ABLIKIM	24R	PR D109 072018	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62669
ABLIKIM	24Y	PR D110 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62678
ABLIKIM	22AQ	PR D106 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61889
ABLIKIM	22M	JHEP 2205 108	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61650
Also		JHEP 2303 022 (errata.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62053
ABLIKIM	22N	JHEP 2205 003	M. Ablikim	(BESIII Collab.)	REFID=61651
ABLIKIM	20AH	PR D102 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60750
ABLIKIM	19AG	PR D99 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59858
ABLIKIM	18M	PR D97 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58901
ABLIKIM	16I	PRL 116 251802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57450
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54741
ABLIKIM	10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53348
ADAMS	09	PR D80 051106	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=53103
DOBBS	08A	PRL 101 182003	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52579
ANDREOTTI	05B	PR D72 032001	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50768
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=50812
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)	REFID=44074
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
ARMSTRONG	92D	PRL 69 2337	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43174
BAGLIN	86	PL B171 135	C. Baglin <i>et al.</i>	(LAPP, CERN, TORI, STRB+)	REFID=43180

NODE=M144

$\chi_{c2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

See the Review on "Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ " before the $\chi_{c0}(1P)$ Listings.

NODE=M057

NODE=M057

 $\chi_{c2}(1P)$ MASS

NODE=M057M

NODE=M057M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3556.17 ± 0.07 OUR AVERAGE				
3557.3 ± 1.7 ± 0.7	611	¹ AAIJ	17BB LHCB	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3556.10 ± 0.06 ± 0.11	4.0k	² AAIJ	17BI LHCB	$\chi_{c2} \rightarrow J/\psi\mu^+\mu^-$
3555.3 ± 0.6 ± 2.2	2.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \text{hadrons}$
3555.70 ± 0.59 ± 0.39		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$
3556.173 ± 0.123 ± 0.020		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
3559.9 ± 2.9		EISENSTEIN	01 CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
3556.4 ± 0.7		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3556.22 ± 0.131 ± 0.020	585	³ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
3556.9 ± 0.4 ± 0.5	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
3557.8 ± 0.2 ± 4		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3553.4 ± 2.2	66	⁵ LEMOIGNE	82 GOLI	$185\pi^-\text{Be} \rightarrow \gamma\mu^+\mu^-A$
3555.9 ± 0.7		⁶ OREGLIA	82 CBAL	$e^+e^- \rightarrow J/\psi 2\gamma$
3557 ± 1.5	69	⁷ HIMEL	80 MRK2	$e^+e^- \rightarrow J/\psi 2\gamma$
3551 ± 11	15	BRANDELIK	79B DASP	$e^+e^- \rightarrow J/\psi 2\gamma$
3553 ± 4		⁷ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3553 ± 4 ± 4		^{7,8} TANENBAUM	78 MRK1	e^+e^-
3563 ± 7	360	⁷ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3555.4 ± 1.3	53	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3543 ± 10	4	WHITAKER	76 MRK1	$e^+e^- \rightarrow J/\psi 2\gamma$

¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c2}(1P)$ fixed to the PDG 16 value.

² AAIJ 17BI reports also $m(\chi_{c2}) - m(\chi_{c1}) = 45.39 \pm 0.07 \pm 0.03$ MeV.

³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

⁴ Using mass of $\psi(2S) = 3686.0$ MeV.

⁵ $J/\psi(1S)$ mass constrained to 3097 MeV.

⁶ Assuming $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁷ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁸ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M057M;LINKAGE=A

NODE=M057M;LINKAGE=B

NODE=M057M;LINKAGE=NW

NODE=M057M;LINKAGE=C

NODE=M057M;LINKAGE=P

NODE=M057M;LINKAGE=E

NODE=M057M;LINKAGE=D

NODE=M057M;LINKAGE=M

 $\chi_{c2}(1P)$ WIDTH

NODE=M057W

NODE=M057W

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.97 ± 0.09 OUR FIT				Error includes scale factor of 1.1. [1.98 ± 0.09 MeV OUR 2024 FIT Scale factor = 1.1]
2.00 ± 0.11 OUR AVERAGE				
2.10 ± 0.20 ± 0.02	4.0k	AAIJ	17BI LHCB	$\chi_{c2} \rightarrow J/\psi\mu^+\mu^-$
1.915 ± 0.188 ± 0.013		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
1.96 ± 0.17 ± 0.07	585	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
2.6 +1.4 -1.0	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 +2.1 -2.0		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

¹ Recalculated by ANDREOTTI 05A.

² Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W;LINKAGE=AN

NODE=M057W;LINKAGE=E

 $\chi_{c2}(1P)$ DECAY MODES

NODE=M057215;NODE=M057

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level

Hadronic decays

				NODE=M057;CLUMP=A
Γ_1	$2(\pi^+\pi^-)$	$(1.12 \pm 0.08) \%$	S=1.5	DESIG=3
Γ_2	$\rho\rho$			DESIG=43
Γ_3	$\pi^+\pi^-\pi^0\pi^0$	$(1.86 \pm 0.24) \%$		DESIG=50
Γ_4	$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(2.22 \pm 0.35) \%$		DESIG=51
Γ_5	$4\pi^0$	$(1.13 \pm 0.15) \times 10^{-3}$		DESIG=62
Γ_6	$K^+K^-\pi^0\pi^0$	$(2.1 \pm 0.4) \times 10^{-3}$		DESIG=52
Γ_7	$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(1.40 \pm 0.20) \%$		DESIG=54
Γ_8	$\rho^-K^+\bar{K}^0 + \text{c.c.}$	$(4.2 \pm 1.3) \times 10^{-3}$		DESIG=55
Γ_9	$K^*(892)^0K^-\pi^+ \rightarrow$ $K^-\pi^+K^0\pi^0 + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-3}$		DESIG=60
Γ_{10}	$K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(3.9 \pm 0.9) \times 10^{-3}$		DESIG=56
Γ_{11}	$K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(3.8 \pm 0.8) \times 10^{-3}$		DESIG=57
Γ_{12}	$K^*(892)^+\bar{K}^0\pi^- \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-3}$		DESIG=58
Γ_{13}	$K^+K^-\eta\pi^0$	$(1.3 \pm 0.4) \times 10^{-3}$		DESIG=59
Γ_{14}	$K^+K^-\pi^+\pi^-$	$(8.4 \pm 1.1) \times 10^{-3}$	S=1.2	DESIG=5
Γ_{15}	$K^+K^-\pi^+\pi^-\pi^0$	$(1.17 \pm 0.13) \%$		DESIG=67
Γ_{16}	$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	$(7.3 \pm 0.8) \times 10^{-3}$		DESIG=78
Γ_{17}	$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(2.1 \pm 1.0) \times 10^{-3}$		DESIG=10
Γ_{18}	$K^*(892)^0\bar{K}^*(892)^0$	$(2.2 \pm 0.9) \times 10^{-3}$	S=2.2	DESIG=21
Γ_{19}	$3(\pi^+\pi^-)$	$(1.53 \pm 0.19) \%$	S=3.8	DESIG=4
Γ_{20}	$\phi\phi$	$(1.23 \pm 0.07) \times 10^{-3}$	S=1.9	DESIG=16
Γ_{21}	$\phi\phi\eta$	$(5.4 \pm 0.7) \times 10^{-4}$		DESIG=99
Γ_{22}	$\omega\omega$	$(8.6 \pm 1.0) \times 10^{-4}$		DESIG=25
Γ_{23}	ωK^+K^-	$(7.3 \pm 0.9) \times 10^{-4}$		DESIG=79
Γ_{24}	$\omega\phi$	$(9.7 \pm 2.8) \times 10^{-6}$		DESIG=68
Γ_{25}	$\pi\pi$	$(2.26 \pm 0.10) \times 10^{-3}$		DESIG=22
Γ_{26}	$\rho^0\pi^+\pi^-$	$(4.0 \pm 1.7) \times 10^{-3}$		DESIG=9
Γ_{27}	$\pi^+\pi^-\pi^0$ (non-resonant)	$(2.0 \pm 0.4) \times 10^{-5}$		DESIG=95
Γ_{28}	$\rho(770)^\pm\pi^\mp$	$(6 \pm 4) \times 10^{-6}$		DESIG=96
Γ_{29}	$\pi^+\pi^-\eta$	$(4.9 \pm 1.3) \times 10^{-4}$		DESIG=39
Γ_{30}	$\pi^+\pi^-\eta'$	$(5.1 \pm 1.9) \times 10^{-4}$		DESIG=42
Γ_{31}	$\eta\eta$	$(5.5 \pm 0.4) \times 10^{-4}$		DESIG=14
Γ_{32}	K^+K^-	$(1.02 \pm 0.15) \times 10^{-3}$	S=2.2	DESIG=2
Γ_{33}	$K_S^0K_S^0$	$(5.3 \pm 0.4) \times 10^{-4}$		DESIG=15
Γ_{34}	$K^*(892)^\pm K^\mp$	$(1.46 \pm 0.21) \times 10^{-4}$		DESIG=87
Γ_{35}	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(1.26 \pm 0.27) \times 10^{-4}$		DESIG=88
Γ_{36}	$K_2^*(1430)^\pm K^\mp$	$(1.51 \pm 0.13) \times 10^{-3}$		DESIG=89
Γ_{37}	$K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	$(1.26 \pm 0.17) \times 10^{-3}$		DESIG=90
Γ_{38}	$K_3^*(1780)^\pm K^\mp$	$(5.2 \pm 0.8) \times 10^{-4}$		DESIG=91
Γ_{39}	$K_3^*(1780)^0\bar{K}^0 + \text{c.c.}$	$(5.7 \pm 2.1) \times 10^{-4}$		DESIG=92
Γ_{40}	$a_2(1320)^0\pi^0$	$(1.31 \pm 0.35) \times 10^{-3}$		DESIG=93
Γ_{41}	$a_2(1320)^\pm\pi^\mp$	$(1.8 \pm 0.6) \times 10^{-3}$		DESIG=94
Γ_{42}	$\bar{K}^0K^+\pi^- + \text{c.c.}$	$(1.30 \pm 0.19) \times 10^{-3}$		DESIG=17
Γ_{43}	$K^+K^-\pi^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=36
Γ_{44}	$K^+K^-\eta$	$< 3.3 \times 10^{-4}$	CL=90%	DESIG=40
Γ_{45}	$K^+K^-\eta'(958)$	$(1.94 \pm 0.34) \times 10^{-4}$		DESIG=82
Γ_{46}	$\eta\eta'$	$(2.2 \pm 0.5) \times 10^{-5}$		DESIG=34
Γ_{47}	$\eta'\eta'$	$(4.6 \pm 0.6) \times 10^{-5}$		DESIG=35
Γ_{48}	$\pi^+\pi^-K_S^0K_S^0$	$(2.2 \pm 0.5) \times 10^{-3}$		DESIG=29
Γ_{49}	$K^+K^-K_S^0K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=30
Γ_{50}	$K_S^0K_S^0K_S^0K_S^0$	$(1.15 \pm 0.18) \times 10^{-4}$		DESIG=97
Γ_{51}	$K^+K^-K^+K^-$	$(1.67 \pm 0.22) \times 10^{-3}$	S=1.1	DESIG=24
Γ_{52}	$K^+K^-\phi$	$(1.44 \pm 0.30) \times 10^{-3}$		DESIG=32
Γ_{53}	$\bar{K}^0K^+\pi^-\phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		DESIG=83
Γ_{54}	$K^+K^-\pi^0\phi$	$(2.7 \pm 0.5) \times 10^{-3}$		DESIG=84

Γ ₅₅	$3(K^+ K^-)$	$(7.2 \pm 1.5) \times 10^{-6}$		DESIG=109
Γ ₅₆	$\phi \pi^+ \pi^- \pi^0$	$(9.3 \pm 1.2) \times 10^{-4}$		DESIG=80
Γ ₅₇	$\rho \bar{\rho}$	$(7.3 \pm 0.4) \times 10^{-5}$	S=1.1	DESIG=11
Γ ₅₈	$\rho \bar{\rho} \pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$		DESIG=37
Γ ₅₉	$\rho \bar{\rho} \eta$	$(1.77 \pm 0.25) \times 10^{-4}$		DESIG=41
Γ ₆₀	$\rho \bar{\rho} \omega$	$(3.7 \pm 0.4) \times 10^{-4}$		DESIG=61
Γ ₆₁	$\rho \bar{\rho} \phi$	$(2.8 \pm 0.9) \times 10^{-5}$		DESIG=66
Γ ₆₂	$\rho \bar{\rho} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Γ ₆₃	$\rho \bar{\rho} \pi^0 \pi^0$	$(8.0 \pm 2.4) \times 10^{-4}$		DESIG=53
Γ ₆₄	$\rho \bar{\rho} K^+ K^-$ (non-resonant)	$(1.94 \pm 0.32) \times 10^{-4}$		DESIG=63
Γ ₆₅	$\rho \bar{\rho} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=28
Γ ₆₆	$\rho \bar{\rho} K_S^0 K^- \pi^+ + \text{c.c.}$	$(5.7 \pm 0.6) \times 10^{-5}$		DESIG=110
Γ ₆₇	$\rho \bar{n} \pi^-$	$(8.7 \pm 1.0) \times 10^{-4}$		DESIG=31
Γ ₆₈	$\bar{\rho} n \pi^+$	$(9.1 \pm 0.8) \times 10^{-4}$		DESIG=75
Γ ₆₉	$\rho \bar{n} \pi^- \pi^0$	$(2.21 \pm 0.18) \times 10^{-3}$		DESIG=76
Γ ₇₀	$\bar{\rho} n \pi^+ \pi^0$	$(2.14 \pm 0.19) \times 10^{-3}$		DESIG=77
Γ ₇₁	$\Lambda \bar{\Lambda}$	$(1.86 \pm 0.16) \times 10^{-4}$		DESIG=19
Γ ₇₂	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.27 \pm 0.16) \times 10^{-3}$		DESIG=27
Γ ₇₃	$\Lambda \bar{\Lambda} \pi^+ \pi^-$ (non-resonant)	$(6.7 \pm 1.5) \times 10^{-4}$		DESIG=70
Γ ₇₄	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	CL=90%	DESIG=71
Γ ₇₅	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	CL=90%	DESIG=72
Γ ₇₆	$\Lambda \bar{\Lambda} \eta$	$(1.07 \pm 0.26) \times 10^{-4}$		DESIG=105
Γ ₇₇	$\Lambda \bar{\Lambda} \omega$	$(1.42 \pm 0.22) \times 10^{-4}$		DESIG=108
Γ ₇₈	$\Lambda \bar{\Lambda} \phi$	$(7.2 \pm 0.9) \times 10^{-5}$		DESIG=107
Γ ₇₉	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(7.9 \pm 0.5) \times 10^{-4}$		DESIG=38
Γ ₈₀	$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(3.63 \pm 0.29) \times 10^{-4}$		DESIG=104
Γ ₈₁	$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(8.3 \pm 1.2) \times 10^{-4}$		DESIG=101
Γ ₈₂	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=64
Γ ₈₃	$\bar{p} \Lambda(1520) K_S^0 \pi^+ + \text{c.c.}$	$(4.1 \pm 1.0) \times 10^{-5}$		DESIG=111
Γ ₈₄	$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.7 \pm 1.5) \times 10^{-4}$		DESIG=65
Γ ₈₅	$\Sigma^0 \bar{\Sigma}^0$	$(3.7 \pm 0.6) \times 10^{-5}$		DESIG=47
Γ ₈₆	$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(8.4 \pm 1.0) \times 10^{-5}$		DESIG=100
Γ ₈₇	$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(9.3 \pm 0.8) \times 10^{-5}$		DESIG=103
Γ ₈₈	$\Sigma^+ \bar{\Sigma}^-$	$(3.4 \pm 0.7) \times 10^{-5}$		DESIG=48
Γ ₈₉	$\Sigma^+ \bar{\Sigma}^- \eta$	$(5.5 \pm 1.3) \times 10^{-5}$		DESIG=112
Γ ₉₀	$\Sigma^- \bar{\Sigma}^+$	$(4.5 \pm 1.8) \times 10^{-5}$		DESIG=102
Γ ₉₁	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=73
Γ ₉₂	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	CL=90%	DESIG=74
Γ ₉₃	$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.79 \pm 0.32) \times 10^{-4}$		DESIG=85
Γ ₉₄	$\Xi^0 \bar{\Xi}^0$	$(1.86 \pm 0.22) \times 10^{-4}$		DESIG=49
Γ ₉₅	$\Xi^- \bar{\Xi}^+$	$(1.46 \pm 0.12) \times 10^{-4}$		DESIG=26
Γ ₉₆	$\Omega^- \bar{\Omega}^+$	$(4.52 \pm 0.30) \times 10^{-5}$		DESIG=106
Γ ₉₇	$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	CL=90%	DESIG=12
Γ ₉₈	$\pi^0 \eta_c$	$< 3.2 \times 10^{-3}$	CL=90%	DESIG=81
Γ ₉₉	$\eta_c(1S) \pi^+ \pi^-$	$< 5.4 \times 10^{-3}$	CL=90%	DESIG=69

Radiative decays

Γ ₁₀₀	$\gamma J/\psi(1S)$	$(19.5 \pm 0.7) \%$	S=1.5	NODE=M057;CLUMP=B DESIG=6
Γ ₁₀₁	$\gamma \rho^0$	$< 1.9 \times 10^{-5}$	CL=90%	DESIG=44
Γ ₁₀₂	$\gamma \omega$	$< 6 \times 10^{-6}$	CL=90%	DESIG=45
Γ ₁₀₃	$\gamma \phi$	$< 8 \times 10^{-6}$	CL=90%	DESIG=46
Γ ₁₀₄	$\gamma \gamma$	$(2.91 \pm 0.12) \times 10^{-4}$	S=1.3	DESIG=7
Γ ₁₀₅	$e^+ e^- J/\psi(1S)$	$(2.20 \pm 0.15) \times 10^{-3}$		DESIG=86
Γ ₁₀₆	$\mu^+ \mu^- J/\psi(1S)$	$(2.07 \pm 0.34) \times 10^{-4}$		DESIG=98

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 88 branching ratios uses 255 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 393.1$ for 206 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x14	5									
x17	1	26								
x18	2	2	0							
x20	4	5	1	1						
x25	16	4	1	2	6					
x26	13	1	0	0	1	2				
x31	8	2	0	1	3	15	1			
x32	4	3	1	1	2	7	1	3		
x33	9	3	1	1	4	16	1	8	4	
x42	5	1	0	1	2	8	1	4	2	5
x51	5	3	1	1	3	8	1	4	3	5
x57	8	6	1	2	5	12	2	6	4	7
x71	8	2	0	1	3	15	1	8	3	8
x100	16	11	3	3	9	25	3	13	8	15
x104	6	-10	-3	-2	-4	18	0	11	0	8
Γ	-19	-17	-4	-5	-13	-26	-4	-13	-10	-16
	x1	x14	x17	x18	x20	x25	x26	x31	x32	x33

x51	2									
x57	4	5								
x71	4	4	6							
x100	7	10	-12	12						
x104	5	2	26	10	12					
Γ	-8	-11	-42	-13	-47	-48				
	x42	x51	x57	x71	x100	x104				

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M057220

NODE=M057223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{57} \Gamma_{100} / \Gamma$$

NODE=M057G1
NODE=M057G1

VALUE (eV) DOCUMENT ID TECN COMMENT

27.9 ± 1.3 OUR FIT Error includes scale factor of 1.1. [28.0 ± 1.3 eV OUR 2024 FIT

NEW

Scale factor = 1.1]

27.5 ± 1.5 OUR AVERAGE

27.0 ± 1.5 ± 1.1	1	ANDREOTTI	05A	E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
27.7 ± 1.5 ± 2.0	1,2	ARMSTRONG	92	E760	$p\bar{p} \rightarrow e^+ e^- \gamma$
36 ± 8	1	BAGLIN	86B	SPEC	$p\bar{p} \rightarrow e^+ e^- X$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

² Recalculated by ANDREOTTI 05A.

NODE=M057G;LINKAGE=7A
NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{104} \Gamma_{100} / \Gamma$$

NODE=M057G2
NODE=M057G2

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

111 ± 5 OUR FIT Error includes scale factor of 1.3. [113 ± 5 eV OUR 2024 FIT

NEW

Scale factor = 1.3]

123 ± 6 OUR AVERAGE

124.1 ± 2.5 ± 5.9	4960	1	SEINO	23	BELL	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
111 ± 12 ± 9	147	2	DOBBS	06	CLE3	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
139 ± 55 ± 21		2,3	ACCIARRI	99E	L3	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

242 ± 65 ± 51	2,4 ACKER.,K...	98	OPAL	$e^+e^- \rightarrow e^+e^- \chi_{c2}$
150 ± 42 ± 36	2,5 DOMINICK	94	CLE2	$e^+e^- \rightarrow e^+e^- \chi_{c2}$
470 ± 240 ± 120	2,6 BAUER	93	TPC	$e^+e^- \rightarrow e^+e^- \chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

114 ± 11 ± 9	136	2,7 ABE	02T BELL	$e^+e^- \rightarrow e^+e^- \chi_{c2}$
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¹ Calculated from the measured $\Gamma_{\gamma\gamma} \times B(\chi_{c2}(1S) \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 14.8 \pm 0.3 \pm 0.7$ eV, using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 11.93 \pm 0.05\%$.

² Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1187 \pm 0.0008$.

³ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACCIARRI 99E is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.0162 \pm 0.0014$.

⁴ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACKERSTAFF,K 98 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1203 \pm 0.0038$.

⁵ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in DOMINICK 94 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

⁶ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in BAUER 93 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

⁷ All systematic errors added in quadrature. Superseded by SEINO 23.

NODE=M057G2;LINKAGE=A

NODE=M057G;LINKAGE=LL

NODE=M057G;LINKAGE=J4

NODE=M057G;LINKAGE=J5

NODE=M057G;LINKAGE=J6

NODE=M057G;LINKAGE=J7

NODE=M057G;LINKAGE=GT

———— $\chi_{c2}(1P) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$ ————

NODE=M057224

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G3
NODE=M057G3

6.4 ± 0.5 OUR FIT Error includes scale factor of 1.5. [5.8 ± 0.7 eV OUR 2024 FIT
Scale factor = 1.4]

NEW

5.2 ± 0.7 OUR AVERAGE

5.01 ± 0.44 ± 0.55	1597 ± 138	UEHARA	08	BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$
6.4 ± 1.8 ± 0.8		EISENSTEIN	01	CLE2	$e^+e^- \rightarrow e^+e^- \chi_{c2}$

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G08
NODE=M057G08

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7.8	90	<598	UEHARA	08	BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$
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$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G09
NODE=M057G09

4.8 ± 0.6 OUR FIT Error includes scale factor of 1.2.

4.42 ± 0.42 ± 0.53 780 ± 74 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G02
NODE=M057G02

6.5 ± 0.9 ± 1.5 1250 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G10
NODE=M057G10

1.3 ± 0.5 OUR FIT Error includes scale factor of 2.3. [1.3 ± 0.5 eV OUR 2024 FIT
Scale factor = 2.3]

NEW

0.8 ± 0.17 ± 0.27 151 ± 30 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{20}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057G12
NODE=M057G12

0.70 ± 0.05 OUR FIT Error includes scale factor of 1.5. [0.71 ± 0.05 eV OUR 2024 FIT
Scale factor = 1.5]

NEW

0.62 ± 0.07 ± 0.05 89 ± 11 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(K^+K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.58 ± 0.18 ± 0.16 26.5 ± 8.1 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+K^-)$

¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M057G12;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M057G03
NODE=M057G03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.64 90 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{24}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04	90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
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¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G04
NODE=M057G04

NODE=M057G04;LINKAGE=LI

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{25}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.29±0.08 OUR FIT Error includes scale factor of 1.2. [1.31 ± 0.08 eV OUR 2024 FIT
Scale factor = 1.2]

1.18±0.25 OUR AVERAGE

1.44±0.54±0.47	34 ± 13	¹ UEHARA	09	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1.14±0.21±0.17	54 ± 10	² NAKAZAWA	05	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$

¹ We multiplied the measurement by 3 to convert from $\pi^0 \pi^0$ to $\pi\pi$. Interference with the continuum included.

² We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057G4
NODE=M057G4
NEW

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

 $\Gamma(\rho^0 \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.3±0.9 OUR FIT

[2.1 ± 0.9 eV OUR 2024 FIT]

3.2±1.9±0.5	986 ± 578	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+ \pi^-)$
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NODE=M057G07
NODE=M057G07
NEW

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{31}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.53±0.22±0.09	8	¹ UEHARA	10A	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$
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¹ Interference with the continuum not included.

NODE=M057G13
NODE=M057G13

NODE=M057G13;LINKAGE=UE

 $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{32}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.58±0.08 OUR FIT Error includes scale factor of 2.1. [0.59 ± 0.09 eV OUR 2024 FIT
Scale factor = 2.1]

0.44±0.11±0.07	33 ± 8	NAKAZAWA	05	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
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NODE=M057G5
NODE=M057G5
NEW

 $\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{33}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.303±0.025 OUR FIT

[0.307 ± 0.026 eV OUR 2024 FIT Scale factor = 1.1]

0.27 ^{+0.07} _{-0.06} ±0.03	53	¹ UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ± 0.05 ± 0.03	38 ± 7	CHEN	07B	BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
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¹ Supersedes CHEN 07B.

NODE=M057G6
NODE=M057G6
NEW

NODE=M057G6;LINKAGE=UE

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{42}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.74±0.11 OUR FIT

[0.75 ± 0.11 eV OUR 2024 FIT]

1.20±0.33±0.13	126	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
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¹ We have multiplied $\bar{K} K \pi$ by 2/3 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$

NODE=M057G01
NODE=M057G01
NEW

NODE=M057G01;LINKAGE=DE

 $\Gamma(K^+ K^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{51}\Gamma_{104}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.95±0.13 OUR FIT Error includes scale factor of 1.1. [0.97 ± 0.13 eV OUR 2024 FIT
Scale factor = 1.1]

1.10±0.21±0.15	126 ± 24	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+ K^-)$
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NODE=M057G11
NODE=M057G11
NEW

 $\Gamma(\eta_c(1S) \pi^+ \pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{99}\Gamma_{104}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<15.7	90	LEES	12AE	BABR $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$
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NODE=M057G05
NODE=M057G05

 $\chi_{c2}(1P)$ BRANCHING RATIOS

NODE=M057225

HADRONIC DECAYS

NODE=M057305

$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma(2(\pi^+ \pi^-))$ Γ_{26} / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M057R38
 NODE=M057R38
 NEW

0.35 ± 0.15 OUR FIT
 [0.36 ± 0.15 OUR 2024 FIT]
0.31 ± 0.17

TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c2}$

 $\Gamma(2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057P07
 NODE=M057P07

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.17 ± 0.06 ± 0.03 1042 ¹ ABLIKIM 24BT BES3 $\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 24BT reports $1.153 \pm 0.001 \pm 0.063$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057P07;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R46
 NODE=M057R46

1.86 ± 0.23 ± 0.05 903.5 ¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.87 \pm 0.07 \pm 0.22 \pm 0.13$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46;LINKAGE=HE

 $\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R47
 NODE=M057R47

2.22 ± 0.34 ± 0.05 1031.9 ^{1,2} HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $2.23 \pm 0.11 \pm 0.32 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R47;LINKAGE=HE

² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M057R47;LINKAGE=OC

 $\Gamma(4\pi^0) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R58
 NODE=M057R58

1.13 ± 0.15 ± 0.03 1164 ¹ ABLIKIM 11A BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 11A reports $(1.21 \pm 0.05 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 4\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_6 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R48
 NODE=M057R48

0.21 ± 0.04 ± 0.01 76.9 ¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.21 \pm 0.03 \pm 0.03 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48;LINKAGE=HE

 $\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R50
 NODE=M057R50

1.40 ± 0.20 OUR AVERAGE [(1.41 ± 0.20)% OUR 2024 AVERAGE]

NEW

1.40 ± 0.20 ± 0.03 211.6 ¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50;LINKAGE=HE

$$\Gamma(\rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.13±0.01	62.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R51
NODE=M057R51

¹ HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.08±0.01	38.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R57
NODE=M057R57

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.39±0.09±0.01	63.0	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R52
NODE=M057R52

¹ HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.38±0.08±0.01	51.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R53
NODE=M057R53

¹ HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.08±0.01	39.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R54
NODE=M057R54

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.129±0.045±0.003	22.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R55
NODE=M057R55

¹ HE 08B reports $0.13 \pm 0.04 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55;LINKAGE=HE

$$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.69±0.13±1.31	11k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R00
NODE=M057R00

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $\text{B}(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R00;LINKAGE=A

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.30±0.11±0.75	4.5k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R73
NODE=M057R73

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $\text{B}(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R73;LINKAGE=A

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma(K^+ K^- \pi^+ \pi^-)$$

 Γ_{17}/Γ_{14}

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M057R39
NODE=M057R39

0.25±0.13 OUR FIT

0.25±0.13

TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c2}$

$$\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}}$$

 Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R4
NODE=M057R4

15.3±1.9 OUR AVERAGE Error includes scale factor of 3.8. $[(15.3 \pm 1.9) \times 10^{-3}$ OUR 2024 AVERAGE Scale factor = 3.8]

NEW

15.9±0.4±0.4 112K ¹ ABLIKIM 22Q BES3 $\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$

8.6±0.9±1.6 ² BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c2}$

8.7±5.9±0.4 ² TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 22Q reports $(1.565 \pm 0.005 \pm 0.048) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 3(\pi^+ \pi^-)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R4;LINKAGE=A

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

NODE=M057R;LINKAGE=X3

$$\Gamma(\phi\phi) / \Gamma_{\text{total}}$$

 Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R20
NODE=M057R20

1.23 ±0.07 OUR FIT Error includes scale factor of 1.9. $[(1.23 \pm 0.07) \times 10^{-3}$ OUR 2024 FIT Scale factor = 1.9]

NEW

1.267±0.028±0.033 4247 ¹ ABLIKIM 23N BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ Measured using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$ and $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

NODE=M057R20;LINKAGE=A

$$\Gamma(\phi\phi\eta) / \Gamma_{\text{total}}$$

 Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R97
NODE=M057R97

5.4±0.6±0.1 143.6 ¹ ABLIKIM 20B BES3 $\psi(2S) \rightarrow \gamma \phi\phi\eta$

¹ ABLIKIM 20B reports $(5.33 \pm 0.52 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi\eta) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R97;LINKAGE=A

$$\Gamma(\omega\omega) / \Gamma_{\text{total}}$$

 Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R28
NODE=M057R28

0.86±0.10 OUR AVERAGE

0.83±0.10±0.02 762 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

1.76±0.58±0.04 27.7±7.4 ² ABLIKIM 05N BES2 $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma 6\pi$

¹ ABLIKIM 11K reports $(8.9 \pm 0.3 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R28;LINKAGE=AL

² ABLIKIM 05N reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.165 \pm 0.044 \pm 0.032) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R28;LINKAGE=AB

$$\Gamma(\omega K^+ K^-) / \Gamma_{\text{total}}$$

 Γ_{23}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R74
NODE=M057R74

0.73±0.04±0.08 512 ¹ ABLIKIM 13B BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R74;LINKAGE=A

$$\Gamma(\omega\phi) / \Gamma_{\text{total}}$$

 Γ_{24}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M057R63
NODE=M057R63

9.7±2.8±0.2 33 ¹ ABLIKIM 19J BES3 $\psi(2S) \rightarrow \gamma$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 90 ^{2,3} ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.91 \pm 0.23 \pm 0.12) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R63;LINKAGE=A

² ABLIKIM 11K reports $< 2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R63;LINKAGE=AL

³ Superseded by ABLIKIM 19J.

NODE=M057R63;LINKAGE=B

$\Gamma(\pi^+\pi^-\pi^0(\text{non-resonant}))/\Gamma_{\text{total}}$

 Γ_{27}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.04±0.43±0.05	64	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M057R84
NODE=M057R84

OCCUR=2

¹ ABLIKIM 17AG reports $(2.1 \pm 0.4 \pm 0.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0(\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R84;LINKAGE=B

$\Gamma(\rho(770)^\pm\pi^\mp)/\Gamma_{\text{total}}$

 Γ_{28}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.62±0.38±0.02	15	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M057R85
NODE=M057R85

¹ ABLIKIM 17AG reports $(0.64 \pm 0.39 \pm 0.07) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho(770)^\pm\pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R85;LINKAGE=A

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$

 Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
0.49±0.13±0.01		¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R08
NODE=M057R08

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5 90 ² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ATHAR 07 reports $(0.49 \pm 0.12 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R08;LINKAGE=AT

² ABLIKIM 06R reports $< 1.7 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R08;LINKAGE=AB

$\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$

 Γ_{30}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.51±0.19±0.01	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R35
NODE=M057R35

¹ ATHAR 07 reports $(0.51 \pm 0.18 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R35;LINKAGE=AT

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$

 Γ_{34}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.46±0.21±0.04	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K \bar{K} \pi$

NODE=M057R86
NODE=M057R86

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.75±0.27±0.04 ² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

OCCUR=2

1.36±0.27±0.03 ³ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=3

¹ ABLIKIM 17AG reports $(1.5 \pm 0.1 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R86;LINKAGE=A

² ABLIKIM 17AG reports $(1.8 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) =$

NODE=M057R86;LINKAGE=B

$= (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))$
 $= (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error
 is the systematic error from using our best value.

³ABLIKIM 17AG reports $(1.4 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow$
 $K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))$
 $= (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))$
 $= (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error
 is the systematic error from using our best value.

NODE=M057R86;LINKAGE=C

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{35}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

1.26±0.27 OUR AVERAGE [(1.27 ± 0.27) × 10⁻⁴ OUR 2024 AVERAGE]NODE=M057R87
NODE=M057R87**1.26±0.27±0.03**¹ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NEW

¹ABLIKIM 17AG reports $(1.3 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow$
 $K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow$
 $\gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow$
 $\gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our
 second error is the systematic error from using our best value.

NODE=M057R87;LINKAGE=A

 $\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{36}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

15.1±1.2±0.4¹ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$ NODE=M057R88
NODE=M057R88

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

17.7±1.6±0.4

²ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

OCCUR=2

13.2±1.5±0.3

³ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=3

¹ABLIKIM 17AG reports $(15.5 \pm 0.6 \pm 1.2) \times 10^{-4}$ from a measurement of
 $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's
 error and our second error is the systematic error from using our best value.

NODE=M057R88;LINKAGE=A

²ABLIKIM 17AG reports $(18.2 \pm 0.8 \pm 1.6) \times 10^{-4}$ from a measurement of
 $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's
 error and our second error is the systematic error from using our best value.

NODE=M057R88;LINKAGE=B

³ABLIKIM 17AG reports $(13.6 \pm 0.8 \pm 1.4) \times 10^{-4}$ from a measurement of
 $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value
 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's
 error and our second error is the systematic error from using our best value.

NODE=M057R88;LINKAGE=C

 $\Gamma(K_2^*(1430)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

12.6±1.7 OUR AVERAGE [(12.7 ± 1.7) × 10⁻⁴ OUR 2024 AVERAGE]NODE=M057R89
NODE=M057R89**12.6±1.7±0.3**¹ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NEW

¹ABLIKIM 17AG reports $(13.0 \pm 1.0 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow$
 $K_2^*(1430)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow$
 $\gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow$
 $\gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our
 second error is the systematic error from using our best value.

NODE=M057R89;LINKAGE=A

 $\Gamma(K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{38}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

5.2±0.8 OUR AVERAGE [(5.3 ± 0.8) × 10⁻⁴ OUR 2024 AVERAGE]NODE=M057R90
NODE=M057R90**5.2±0.8±0.1**¹ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

NEW

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

5.1±1.0±0.1

²ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

OCCUR=2

5.7±1.8±0.1

³ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=3

¹ ABLIKIM 17AG reports $(5.4 \pm 0.5 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R90;LINKAGE=A

² ABLIKIM 17AG reports $(5.3 \pm 0.5 \pm 0.9) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R90;LINKAGE=B

³ ABLIKIM 17AG reports $(5.9 \pm 1.1 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R90;LINKAGE=C

$\Gamma(K_3^*(1780)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
5.7±2.1±0.1	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057R91
NODE=M057R91

¹ ABLIKIM 17AG reports $(5.9 \pm 1.6 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R91;LINKAGE=A

$\Gamma(a_2(1320)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
13.1±3.4±0.3	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

NODE=M057R92
NODE=M057R92

¹ ABLIKIM 17AG reports $(13.5 \pm 1.6 \pm 3.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow a_2(1320)^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R92;LINKAGE=A

$\Gamma(a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
17.9±6.2±0.4	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057R93
NODE=M057R93

¹ ABLIKIM 17AG reports $(18.4 \pm 3.3 \pm 5.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R93;LINKAGE=A

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.31±0.08±0.01	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R05
NODE=M057R05

¹ ATHAR 07 reports $(0.31 \pm 0.07 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R05;LINKAGE=AT

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.33	90		¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R09
NODE=M057R09

••• We do not use the following data for averages, fits, limits, etc. •••

0.181±0.004	3693	² ABLIKIM	24BWBES3	$\psi(2S) \rightarrow \gamma\chi_{c2}$
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¹ ATHAR 07 reports $< 0.33 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R09;LINKAGE=AT

² No systematic error reported.

NODE=M057R09;LINKAGE=A

$\Gamma(K^+ K^- \eta'(958))/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.94±0.34	107	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M057R78
 NODE=M057R78

¹ Derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.72 \pm 0.34)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

NODE=M057R78;LINKAGE=A

 $\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.5±0.1		20	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta \eta'$

NODE=M057R03
 NODE=M057R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6	90	3.3 ± 8.0	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta \eta'$
< 23	90		³ ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 17AI reports $(2.27 \pm 0.43 \pm 0.25) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R03;LINKAGE=A

² ASNER 09 reports $< 0.6 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R03;LINKAGE=AS

³ Superseded by ASNER 09. ADAMS 07 reports $< 2.3 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R03;LINKAGE=AD

 $\Gamma(\eta'\eta')/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.6±0.6±0.1		60	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta'$

NODE=M057R04
 NODE=M057R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 10	90	12 ± 7	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta' \eta'$
< 31	90		³ ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 17AI reports $(4.76 \pm 0.56 \pm 0.38) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R04;LINKAGE=A

² ASNER 09 reports $< 1.0 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AS

³ Superseded by ASNER 09. ADAMS 07 reports $< 3.1 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AD

 $\Gamma(\pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.5±0.1	57 ± 11	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R31
 NODE=M057R31

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.207 \pm 0.039 \pm 0.033) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R31;LINKAGE=AB

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 4	90	2.3 ± 2.2	¹ ABLIKIM	050 BES2	$e^+ e^- \rightarrow \chi_{c2} \gamma$

NODE=M057R32
 NODE=M057R32

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] < 3.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R32;LINKAGE=AB

$\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15±0.18±0.03	68	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$

NODE=M057R94
 NODE=M057R94

¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (10.8 \pm 1.5 \pm 0.8) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M057R94;LINKAGE=A

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.30 OUR AVERAGE [(1.45 ± 0.30) × 10 ⁻³ OUR 2024 AVERAGE]				
1.44±0.30±0.03	52	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M057R01
 NODE=M057R01

NEW

¹ ABLIKIM 06T reports $(1.67 \pm 0.26 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R01;LINKAGE=AB

 $\Gamma(K^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.83±0.32±0.66	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R79
 NODE=M057R79

 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.74±0.16±0.44	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R80
 NODE=M057R80

 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.93±0.06±0.10	408	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R75
 NODE=M057R75

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R75;LINKAGE=A

 $\Gamma(p \bar{p} \pi^0)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.47±0.04 OUR AVERAGE			
0.48±0.04±0.01	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$
0.44±0.09±0.01	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R06
 NODE=M057R06

¹ ONYISI 10 reports $(4.83 \pm 0.25 \pm 0.35 \pm 0.31) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=ON

² ATHAR 07 reports $(0.44 \pm 0.08 \pm 0.05) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=AT

 $\Gamma(p \bar{p} \eta)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.177±0.025 OUR AVERAGE			
0.175±0.026±0.004	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$
0.189±0.071±0.005	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R34
 NODE=M057R34

¹ ONYISI 10 reports $(1.76 \pm 0.23 \pm 0.14 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=ON

² ATHAR 07 reports $(0.19 \pm 0.07 \pm 0.02) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=AT

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID TECN COMMENT

0.37±0.04±0.01¹ ONYISI 10 CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$

¹ ONYISI 10 reports $(3.68 \pm 0.35 \pm 0.26 \pm 0.24) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{60}/Γ NODE=M057R56
NODE=M057R56

NODE=M057R56;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID TECN COMMENT

2.8±0.9±0.1

24 ± 7

¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(3.04 \pm 0.85 \pm 0.43) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{61}/Γ NODE=M057R62
NODE=M057R62

NODE=M057R62;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID TECN COMMENT

1.32±0.34 OUR EVALUATION Treating systematic error as correlated.**1.3 ± 0.4 OUR AVERAGE** Error includes scale factor of 1.3.

1.17±0.19±0.30

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.64±1.03±0.14

¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

 Γ_{62}/Γ NODE=M057R6
NODE=M057R6

→ UNCHECKED ←

NODE=M057R6;LINKAGE=X3

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (%)

EVTS

DOCUMENT ID TECN COMMENT

0.080±0.024±0.002

29.2

¹ HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.08 \pm 0.02 \pm 0.01 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{63}/Γ NODE=M057R49
NODE=M057R49

NODE=M057R49;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID TECN COMMENT

1.94±0.32 OUR AVERAGE [(1.94 ± 0.33) × 10⁻⁴ OUR 2024 AVERAGE]**1.94±0.32±0.05**

131 ± 12

¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(2.08 \pm 0.19 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{64}/Γ NODE=M057R59
NODE=M057R59

NEW

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID TECN COMMENT

<7.9

90

¹ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c2}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

 Γ_{65}/Γ NODE=M057R30
NODE=M057R30

NODE=M057R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID TECN COMMENT

8.7±1.0 OUR AVERAGE

8.5±1.0±0.2

3309

¹ ABLIKIM 12J BES3 $\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$

10.3±3.5±0.3

² ABLIKIM 06I BES2 $\psi(2S) \rightarrow \gamma p\pi^- X$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.80 \pm 0.02 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33
NODE=M057R33

NODE=M057R33;LINKAGE=AL

² ABLIKIM 06I reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.97 \pm 0.20 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33;LINKAGE=AB

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±0.8±0.2	3732	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+$

NODE=M057R70
NODE=M057R70

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.85 \pm 0.02 \pm 0.07) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R70;LINKAGE=AL

 $\Gamma(\rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.1±1.7±0.5	2128	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-\pi^0$

NODE=M057R71
NODE=M057R71

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (2.07 \pm 0.06 \pm 0.15) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R71;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.4±1.9 OUR AVERAGE				$[(21.5 \pm 1.9) \times 10^{-4}$ OUR 2024 AVERAGE]
21.4±1.8±0.5	2352	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+\pi^0$

NODE=M057R72
NODE=M057R72

NEW

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (2.01 \pm 0.06 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R72;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
127±16 OUR AVERAGE					$[(128 \pm 16) \times 10^{-5}$ OUR 2024 AVERAGE]
127±15±3		371	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M057R29
NODE=M057R29

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

<350	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$
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¹ ABLIKIM 12I reports $(137.0 \pm 7.6 \pm 15.7) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R29;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R29;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
67±15±2	36	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M057R65
NODE=M057R65

NODE=M057R65;LINKAGE=AL

¹ ABLIKIM 12I reports $(71.8 \pm 14.5 \pm 8.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M057R66
NODE=M057R66

NODE=M057R66;LINKAGE=AL

¹ ABLIKIM 12I reports $< 42 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<60	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma\Sigma(1385)^-\bar{\Lambda}\pi^+$

NODE=M057R67
NODE=M057R67

NODE=M057R67;LINKAGE=AL

¹ ABLIKIM 12I reports $< 61 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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7.9±0.5 OUR AVERAGE[(7.9 ± 0.6) × 10⁻⁴ OUR 2024 AVERAGE]

7.8±0.5±0.2	5k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
8.5±1.6±0.2		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ABLIKIM 13D reports $(8.4 \pm 0.3 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

³ ATHAR 07 reports $(8.5 \pm 1.4 \pm 1.0) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R07
NODE=M057R07

NEW

NODE=M057R07;LINKAGE=AB

NODE=M057R07;LINKAGE=LB
NODE=M057R07;LINKAGE=AT $\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.63±0.29 OUR AVERAGE [(3.64 ± 0.29) × 10⁻⁴ OUR 2024 AVERAGE]

3.63±0.27±0.09	879	¹ ABLIKIM	21AV BES3	$\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$
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¹ ABLIKIM 21AV reports $(3.58 \pm 0.16 \pm 0.23) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0952 \pm 0.0020$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.

NODE=M057P01
NODE=M057P01

NEW

NODE=M057P01;LINKAGE=B

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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8.3±1.2±0.2	476	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$
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¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.9 \pm 0.6) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R98
NODE=M057R98

NODE=M057R98;LINKAGE=F

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.9±0.7±0.1	79 ± 13	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
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¹ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60
NODE=M057R60

NODE=M057R60;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.7±1.5±0.1	29 ± 7	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
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¹ ABLIKIM 11F reports $(5.05 \pm 1.29 \pm 0.93) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R61
NODE=M057R61

NODE=M057R61;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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3.7±0.6±0.1		91	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
<7	90	7.5 ± 3.4	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

NODE=M057R43
NODE=M057R43

- ¹ ABLIKIM 18V reports $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.35 \pm 0.05 \pm 0.02) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 13H reports $< 0.65 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.
- ³ NAIK 08 reports $< 0.75 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R43;LINKAGE=A

NODE=M057R43;LINKAGE=AB

NODE=M057R43;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.4±0.7±0.1		55	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<7	90	4.0 ± 3.5	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M057R44
NODE=M057R44

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

- ¹ ABLIKIM 18V reports $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.32 \pm 0.06 \pm 0.03) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 13H reports $< 0.88 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.
- ³ NAIK 08 reports $< 0.67 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R44;LINKAGE=A

NODE=M057R44;LINKAGE=AB

NODE=M057R44;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.3±0.1	35	¹ ABLIKIM	24CA BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}(1P)$

NODE=M057P11
NODE=M057P11

- ¹ ABLIKIM 24CA reports $(5.46 \pm 1.18 \pm 0.50) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057P11;LINKAGE=A

$\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5±1.8±0.1	131	¹ ABLIKIM	20I BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

NODE=M057R99
NODE=M057R99

- ¹ ABLIKIM 20I reports $(4.4 \pm 1.7 \pm 0.5) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R99;LINKAGE=A

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<16	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Sigma}(1385)^-$

NODE=M057R68
NODE=M057R68

- ¹ ABLIKIM 12I reports $< 17 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R68;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Sigma}(1385)^+$

NODE=M057R69
NODE=M057R69

- ¹ ABLIKIM 12I reports $< 8.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R69;LINKAGE=AL

$\Gamma(K^- \Lambda_{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.32 OUR AVERAGE		[(1.80 ± 0.32) × 10 ⁻⁴	OUR 2024 AVERAGE]	
1.79±0.32±0.04	51	¹ ABLIKIM	15i BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda_{\Xi}^+ + \text{c.c.}$
¹ ABLIKIM 15i reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^- \Lambda_{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (1.68 \pm 0.26 \pm 0.15) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R81
NODE=M057R81

NEW

NODE=M057R81;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.22±0.04		804	¹ ABLIKIM	220 BES3	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.1	90	3	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
¹ ABLIKIM 220 reports $(1.83 \pm 0.15 \pm 0.16) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.38 \times 10^{-2}$.					

NODE=M057R45
NODE=M057R45

NODE=M057R45;LINKAGE=A

NODE=M057R45;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.46±0.12 OUR AVERAGE					
1.46±0.12±0.04		1691	¹ ABLIKIM	220 BES3	$\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$
1.44±0.32±0.03	29 ± 5		² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		³ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2} \gamma$
¹ ABLIKIM 220 reports $(1.44 \pm 0.06 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
³ Using $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (9.3 \pm 0.6)\%$.					

NODE=M057R17
NODE=M057R17

NODE=M057R17;LINKAGE=A

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.52±0.24±0.18	1038	ABLIKIM	23T BES3	$\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$

NODE=M057P03
NODE=M057P03 $\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE	81 SPEC	190 GeV $\pi^- \text{Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
NODE=M057R13 $\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.2 × 10⁻³	90	¹ ABLIKIM	15N BES3	$\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$
¹ Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.				

NODE=M057R77
NODE=M057R77

NODE=M057R77;LINKAGE=A

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.54 × 10⁻²	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.2 × 10 ⁻²	90	^{1,3} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.				
² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.				
³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.				

NODE=M057R76
NODE=M057R76

OCCUR=2

NODE=M057R76;LINKAGE=A

NODE=M057R76;LINKAGE=B

NODE=M057R76;LINKAGE=C

$\Gamma(\eta_c(1S)\pi^+\pi^-)/\Gamma(\bar{K}^0 K^+\pi^- + \text{c.c.})$ Γ_{99}/Γ_{42}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<16.4	90	¹ LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$

NODE=M057R64
 NODE=M057R64

¹We divided the reported limit by 2 to take into account the $K_L^0 K^+\pi^-$ mode.

NODE=M057R64;LINKAGE=LE

NODE=M057310

RADIATIVE DECAYS

 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<19	90	13 ± 11	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$

NODE=M057R40
 NODE=M057R40

••• We do not use the following data for averages, fits, limits, etc. •••

<40	90	17.2 ± 6.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$
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NODE=M057R40;LINKAGE=AB

¹ABLIKIM 11E reports $< 20.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

²BENNETT 08A reports $< 50 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R40;LINKAGE=BE

 $\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<6	90	1 ± 6	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\omega$

NODE=M057R41
 NODE=M057R41

••• We do not use the following data for averages, fits, limits, etc. •••

<6	90	0.0 ± 1.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$
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NODE=M057R41;LINKAGE=AB

¹ABLIKIM 11E reports $< 6.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

²BENNETT 08A reports $< 7.0 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R41;LINKAGE=BE

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{103}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 8	90	5 ± 5	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$

NODE=M057R42
 NODE=M057R42

••• We do not use the following data for averages, fits, limits, etc. •••

<11	90	1.3 ± 2.5	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\phi$
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NODE=M057R42;LINKAGE=AB

¹ABLIKIM 11E reports $< 8.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

²BENNETT 08A reports $< 13 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.38 \times 10^{-2}$.

NODE=M057R42;LINKAGE=BE

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.41 \pm 0.15 \pm 0.06$	1.3k	^{1,2} ABLIKIM	17I BES3	$\psi(2S) \rightarrow \gamma e^+e^- J/\psi$

NODE=M057R82
 NODE=M057R82

••• We do not use the following data for averages, fits, limits, etc. •••

¹ABLIKIM 17I reports $(2.48 \pm 0.08 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow e^+e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.38 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R82;LINKAGE=B

²Not independent from other measurements reported by ABLIKIM 17I

NODE=M057R82;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ $\Gamma_{105}/\Gamma_{100}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$11.3 \pm 0.4 \pm 0.5$	1.3k	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^- \gamma J/\psi$

NODE=M057R83
 NODE=M057R83

¹Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) \times B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (199.6 \pm 0.8 \pm 7.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M057R83;LINKAGE=A

$$\Gamma(\mu^+ \mu^- J/\psi(1S))/\Gamma(e^+ e^- J/\psi(1S))$$

 $\Gamma_{106}/\Gamma_{105}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.40±0.79±1.15	219	ABLIKIM	19Z BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma(\mu^+ \mu^- J/\psi)$

NODE=M057R96
NODE=M057R96

$$\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$$

 $\Gamma_{104}/\Gamma_{100}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.49±0.08 OUR FIT			Error includes scale factor of 1.5. $[(1.50 \pm 0.08) \times 10^{-3}$ OUR 2024 FIT Scale factor = 1.5]
0.99±0.18	¹ AMBROGIANI 00B	E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

NODE=M057R23
NODE=M057R23

NEW

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M057R;LINKAGE=7A

$$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(\bar{p}p)/\Gamma_{\text{total}}$$

 $\Gamma_{104}/\Gamma \times \Gamma_{57}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
2.12±0.15 OUR FIT			Error includes scale factor of 1.2.
1.7 ±0.4 OUR AVERAGE			
1.60±0.42	ARMSTRONG 93	E760	$\bar{p}p \rightarrow \gamma\gamma X$
9.9 ±4.5	BAGLIN 87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma X$

NODE=M057R24
NODE=M057R24

$\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

$$\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

 $\Gamma_1/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.04±0.21 OUR FIT			Error includes scale factor of 1.6. $[(2.7 \pm 0.4) \times 10^{-3}$ OUR 2024 FIT Scale factor = 1.4]
3.1 ±1.0 OUR AVERAGE			Error includes scale factor of 2.5.
2.3 ±0.1 ±0.5	¹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
4.3 ±0.6	² TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B5
NODE=M057B5

NEW

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=K1

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B;LINKAGE=K2

$$\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

 $\Gamma_1/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.05 ±0.07 OUR FIT				Error includes scale factor of 1.6.
1.098±0.001±0.055	1042	¹ ABLIKIM 24BT	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057P08
NODE=M057P08

¹ Calculated by us. The value given here is derived from the value of $B(\chi_{c2} \rightarrow 2(\pi^+ \pi^-))$ reported in ABLIKIM 24BT using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.52 \pm 0.20)\%$ [PDG 22].

NODE=M057P08;LINKAGE=A

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

 $\Gamma_{14}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.27±0.31 OUR FIT			Error includes scale factor of 1.2. $[(2.24 \pm 0.30) \times 10^{-3}$ OUR 2024 FIT Scale factor = 1.2]
2.5 ±0.9 OUR AVERAGE			Error includes scale factor of 2.3.
1.90±0.14±0.44	BAI 99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
3.8 ±0.67	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B18
NODE=M057B18

NEW

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18;LINKAGE=TA

$$\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

 $\Gamma_{18}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.1 ±0.9 OUR FIT			Error includes scale factor of 2.3. $[(2.1 \pm 0.9) \times 10^{-4}$ OUR 2024 FIT Scale factor = 2.3]
3.11±0.36±0.48	ABLIKIM 04H	BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B19
NODE=M057B19

NEW

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{20}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15±0.07 OUR FIT				Error includes scale factor of 1.7. $[(1.15 \pm 0.07) \times 10^{-4}$ OUR 2024 FIT Scale factor = 1.8]
0.98±0.13 OUR AVERAGE				Error includes scale factor of 1.3.
0.94±0.03±0.10	849	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons
1.38±0.24±0.23	41	² ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M057B16
NODE=M057B16

NEW

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.

NODE=M057B16;LINKAGE=AL

² Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{20}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.32±0.21 OUR FIT			Error includes scale factor of 1.7. $[(3.31 \pm 0.21) \times 10^{-4}$ OUR 2024 FIT Scale factor = 1.7]

NODE=M057B17
NODE=M057B17

NEW

$$4.8 \pm 1.3 \pm 1.3 \quad \text{}^1 \text{BAI} \quad 99B \text{ BES} \quad \psi(2S) \rightarrow \gamma 2K^+ 2K^-$$

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{25}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.12±0.08 OUR FIT				
2.17±0.09 OUR AVERAGE				

NODE=M057B02
NODE=M057B02

2.19±0.05±0.15	4.5k	¹ ABLIKIM	10A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$
2.23±0.06±0.10	2.5k	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1.90±0.08±0.20	0.8k	³ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$

OCCUR=2

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \pi^0\pi^0) = (0.88 \pm 0.02 \pm 0.06 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M057B02;LINKAGE=AB

² Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^+\pi^-) = (1.59 \pm 0.04 \pm 0.07 \pm 0.10) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057B02;LINKAGE=AS

³ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^0\pi^0) = (0.68 \pm 0.03 \pm 0.07 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{25}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.611±0.023 OUR FIT				$[(0.611 \pm 0.024) \times 10^{-3}$ OUR 2024 FIT]

NODE=M057B9
NODE=M057B9

NEW

0.66 ± 0.18 ± 0.37	21 ± 6	¹ BAI	03C BES	$\psi(2S) \rightarrow \gamma\pi^0\pi^0$
0.54 ± 0.05 ± 0.04	185 ± 16	² BAI	98I BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$

¹ We have multiplied $\pi^0\pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M057B;LINKAGE=BM

² Calculated by us. The value for $B(\chi_{c2} \rightarrow \pi^+\pi^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{31}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}{\Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.52±0.04 OUR FIT					
0.52±0.04 OUR AVERAGE					
0.54±0.03±0.04		386	¹ ABLIKIM	10A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$
0.47±0.05±0.05		156	ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma\eta\eta$

NODE=M057B04
NODE=M057B04

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.44	90	² ADAMS	07	CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2}$
< 3	90	BAI	03C	BES	$\psi(2S) \rightarrow \gamma\eta\eta \rightarrow 5\gamma$
$0.62 \pm 0.31 \pm 0.19$		LEE	85	CBAL	$\psi(2S) \rightarrow \text{photons}$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \eta\eta) = (0.65 \pm 0.04 \pm 0.05 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$.

NODE=M057B04;LINKAGE=AB

² Superseded by ASNER 09.

NODE=M057B04;LINKAGE=AD

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{32} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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9.5 ± 1.4 OUR FIT Error includes scale factor of 2.4. $[(9.5 \pm 1.4) \times 10^{-5}$ OUR 2024 FIT Scale factor = 2.4]

NODE=M057B03
NODE=M057B03

NEW

10.5 ± 0.3 ± 0.6 1.6k ¹ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K^+ K^-) = (1.13 \pm 0.03 \pm 0.06 \pm 0.07) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B03;LINKAGE=AS

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma_{32} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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0.28 ± 0.04 OUR FIT Error includes scale factor of 2.3. $[(0.27 \pm 0.04) \times 10^{-3}$ OUR 2024 FIT Scale factor = 2.4]

NODE=M057B8
NODE=M057B8

NEW

0.190 ± 0.034 ± 0.019 115 ± 13 ¹ BAI 98i BES $\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow K^+ K^-)$ reported by BAI 98i is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=BI

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{33} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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5.0 ± 0.4 OUR FIT

5.0 ± 0.4 OUR AVERAGE

4.9 ± 0.3 ± 0.3 373 ± 20 ¹ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
5.72 ± 0.76 ± 0.63 65 ABLIKIM 050 BES2 $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M057B12
NODE=M057B12

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K_S^0 K_S^0) = (0.53 \pm 0.03 \pm 0.03 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B12;LINKAGE=AS

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma_{33} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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14.3 ± 1.1 OUR FIT

14.7 ± 4.1 ± 3.3

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow K_S^0 K_S^0)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B13
NODE=M057B13

NODE=M057B13;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{42} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.22 ± 0.18 OUR FIT

$[(1.22 \pm 0.17) \times 10^{-4}$ OUR 2024 FIT]

1.15 ± 0.18 OUR AVERAGE

1.21 ± 0.19 ± 0.09 37 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
0.97 ± 0.32 ± 0.13 28 ² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057B05
NODE=M057B05

NEW

¹ Calculated by us. ATHAR 07 reports $B(\chi_{c2} \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (1.3 \pm 0.2 \pm 0.1 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B05;LINKAGE=AT

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c2} \rightarrow K_S^0 K^\pm \pi^\mp) = (0.6 \pm 0.2 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.1 \pm 0.6)\%$. We have multiplied by 2 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$ from $K_S^0 K^\pm \pi^\mp$.

NODE=M057B05;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{51} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.57±0.21 OUR FIT				Error includes scale factor of 1.1. [(1.56 ± 0.21) × 10 ⁻⁴ OUR 2024 FIT Scale factor = 1.1]

NODE=M057B14
NODE=M057B14

NEW

1.76±0.16±0.24	160	¹ ABLIKIM	06T	BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.				

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \Gamma_{51} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.5±0.6 OUR FIT			Error includes scale factor of 1.1.

NODE=M057B15
NODE=M057B15

3.6±0.6±0.6		¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].				

NODE=M057B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow 3(K^+ K^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{55} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
6.8±1.1±0.8	46.4 ± 7.0	¹ ABLIKIM	24P	BES3 $e^+ e^- \rightarrow \psi(2S)$

NODE=M057P05
NODE=M057P05

¹ Systematic error derived by us, based on the text.

NODE=M057P05;LINKAGE=A

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{J/\psi(1S)\pi^+\pi^- \Gamma_{57} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.97±0.10 OUR FIT			Error includes scale factor of 1.1. [(1.96 ± 0.10) × 10 ⁻⁵ OUR 2024 FIT Scale factor = 1.1]

NODE=M057B1
NODE=M057B1

NEW

1.4 ± 1.1		¹ BAI	98I	BES $\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma p\bar{p}$
¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].				

NODE=M057B;LINKAGE=J8

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{57} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.83±0.34 OUR FIT				Error includes scale factor of 1.1. [(6.79 ± 0.34) × 10 ⁻⁶ OUR 2024 FIT Scale factor = 1.1]

NODE=M057B6
NODE=M057B6

NEW

7.1 ± 0.5 OUR AVERAGE				Error includes scale factor of 1.2.
7.3 ± 0.4 ± 0.3	405	ABLIKIM	13V	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$
7.2 ± 0.7 ± 0.4	121 ± 12	¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$
4.4 $\begin{smallmatrix} +1.6 \\ -1.4 \end{smallmatrix}$ ± 0.6	14.3 $\begin{smallmatrix} +5.2 \\ -4.7 \end{smallmatrix}$	BAI	04F	BES $\psi(2S) \rightarrow \gamma \chi_{c2}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow p\bar{p}) = (7.7 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K_S^0 K^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{66} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
5.36±0.26±0.43	574	ABLIKIM	24BX	BES3 $\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057P09
NODE=M057P09

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}\Lambda(1520)K_S^0 \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{83} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.89$\begin{smallmatrix} +0.83 \\ -0.80 \end{smallmatrix}$±0.39	94	ABLIKIM	24BX	BES3 $\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057P10
NODE=M057P10

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{71}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
17.4±1.4 OUR FIT				
17.3±1.5 OUR AVERAGE				

18.2±0.8±1.7	670	ABLIKIM	21L BES3	$\psi(2S) \rightarrow \gamma p \pi^- \bar{p} \pi^+$
15.9±2.1±1.0	71	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

18.2±1.4±0.9	207	^{2,3} ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$
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¹ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (17.0 \pm 2.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

² Superseded by ABLIKIM 21L

³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (20.8 \pm 1.6 \pm 2.3) \times 10^{-5}$ from a measurement of $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c2})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.74 \pm 0.35)\%$.

NODE=M057B10
NODE=M057B10

NODE=M057B10;LINKAGE=NA

NODE=M057B10;LINKAGE=A
NODE=M057B10;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{71}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.0±0.4 OUR FIT				

7.1^{+3.1}_{-2.9}±1.3	8.3 ^{+3.7} _{-3.4}	¹ BAI	03E BES	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$
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¹ BAI 03E reports $[B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c2}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.59}_{-0.55} \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M057B11
NODE=M057B11

NODE=M057B11;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{76}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.00±0.20±0.14	32	ABLIKIM	22A0 BES3	$\psi(2S) \rightarrow \gamma p \pi^- \bar{p} \pi^+ \gamma\gamma$

NODE=M057P02
NODE=M057P02

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\omega)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{77}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
13.3±1.2±1.6	251 ± 23	¹ ABLIKIM	24BE BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057P06
NODE=M057P06

¹ Calculated by us. The authors report $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}\omega)$ obtained from a product using PDG 22 value of $B(\psi(2S) \rightarrow \gamma\chi_{c2})$.

NODE=M057P06;LINKAGE=A

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{78}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.79±0.77±0.35	94.4	ABLIKIM	24AC BES3	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057P04
NODE=M057P04

$$\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{86}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.85±0.77±0.44	129	¹ ABLIKIM	19BB BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

NODE=M057B07
NODE=M057B07

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c2} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (8.25 \pm 0.83 \pm 0.49) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.52 \pm 0.20)\%$ and other branching fractions from PDG 18.

NODE=M057B07;LINKAGE=A

$$\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{87}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.87±0.06±0.04	271	¹ ABLIKIM	20AE BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

NODE=M057P00
NODE=M057P00

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_{c2} \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (0.91 \pm 0.06 \pm 0.05) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.52 \pm 0.20)\%$ and other branching fractions from PDG 20.

NODE=M057P00;LINKAGE=A

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{100}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}{183}$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.83 ± 0.06 OUR FIT				Error includes scale factor of 1.8. [(1.82 ± 0.07) × 10 ⁻² OUR 2024 FIT Scale factor = 1.9]
1.69 ± 0.16 OUR AVERAGE				Error includes scale factor of 3.4. See the ideogram below.
1.996 ± 0.008 ± 0.070	81k	1 ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$
1.793 ± 0.008 ± 0.163	1.0M	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
1.62 ± 0.04 ± 0.12	5.8k	BAI	04I BES2	$\psi(2S) \rightarrow J/\psi \gamma \gamma$
0.99 ± 0.10 ± 0.08		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
1.47 ± 0.17		2 OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \chi_{c2}$
1.8 ± 0.5		3 BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma \chi_{c2}$
1.2 ± 0.2		3 BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma \chi_{c2}$
2.2 ± 1.2		4 BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
1.2 ± 0.7		2 WHITAKER	76 MRK1	$e^+ e^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.874 ± 0.007 ± 0.102	76k	5 ABLIKIM	120 BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$
1.95 ± 0.02 ± 0.07	12.4k	6 MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
1.85 ± 0.04 ± 0.07	1.9k	7 ADAM	05A CLEO	Repl. by MENDEZ 08

NODE=M057B2
NODE=M057B2

NEW

- ¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$.
- ² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.
- ³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.
- ⁴ Assumes isotropic gamma distribution.
- ⁵ Superseded by ABLIKIM 17N.
- ⁶ Not independent from other measurements of MENDEZ 08.
- ⁷ Not independent from other values reported by ADAM 05A.

NODE=M057B2;LINKAGE=A

NODE=M057B;LINKAGE=3Q

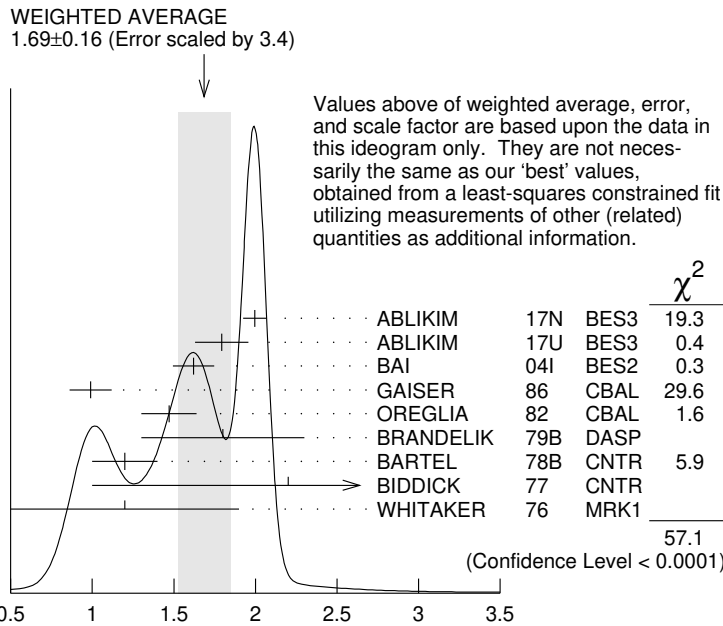
NODE=M057B;LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=B

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD



$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \text{ (units } 10^{-2}\text{)}$$

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{100}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}}{12}$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
5.27 ± 0.18 OUR FIT				Error includes scale factor of 1.8. [(5.26 ± 0.19) × 10 ⁻² OUR 2024 FIT Scale factor = 1.8]
5.53 ± 0.17 OUR AVERAGE				
5.56 ± 0.05 ± 0.16	12.4k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
6.0 ± 2.8	1.3k	1 ABLIKIM	04B BES	$\psi(2S) \rightarrow J/\psi X$
3.9 ± 1.2		2 HIMEL	80 MRK2	$\psi(2S) \rightarrow \gamma \chi_{c2}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
5.52 ± 0.13 ± 0.13	1.9k	3 ADAM	05A CLEO	Repl. by MENDEZ 08

NODE=M057B3
NODE=M057B3

NEW

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma\chi_{c2}) \times B(\chi_{c2} \rightarrow \gamma J/\psi(1S))$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

NODE=M057B;LINKAGE=AB

NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{104} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.73±0.11 OUR FIT				Error includes scale factor of 1.3. $[(2.74 \pm 0.10) \times 10^{-5}$ OUR 2024 FIT Scale factor = 1.3]

NODE=M057B4
NODE=M057B4

NEW

2.82±0.10 OUR AVERAGE

2.83±0.08±0.06	5k	¹ ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow 3\gamma$
2.68±0.28±0.15	0.3k	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow 3\gamma$
7.0 ±2.1 ±2.0		LEE	85 CBAL	$\psi(2S) \rightarrow \gamma\chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.81±0.17±0.15	1.1k	² ABLIKIM	12A BES3	$\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow 3\gamma$
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NODE=M057B4;LINKAGE=A

¹ ABLIKIM 17AE measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \Gamma_{\gamma\gamma}^{\lambda=0} / \Gamma_{\gamma\gamma}^{\lambda=2} = 0.000 \pm 0.006 \pm 0.012$.

² ABLIKIM 12A measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \Gamma_{\gamma\gamma}^{\lambda=0} / \Gamma_{\gamma\gamma}^{\lambda=2} = 0.00 \pm 0.02 \pm 0.02$. Superseded by ABLIKIM 17AE.

NODE=M057B4;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma) / \Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)$$

$$\Gamma_{104} / \Gamma_{104}^{\chi_{c0}(1P)}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.292±0.028 OUR AVERAGE				

NODE=M057B06
NODE=M057B06

0.295±0.014±0.028	8k	¹ ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$
0.278±0.050±0.036	0.5k	¹ ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.271±0.029±0.030	1.9k	^{1,2} ABLIKIM	12A BES3	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$
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¹ Not independent from the values of $\Gamma(\chi_{c0}, \chi_{c2})$ and $B(\psi(2S) \rightarrow \chi_{c0}, \chi_{c2})$.

² Superseded by ABLIKIM 17AE.

NODE=M057B06;LINKAGE=AB
NODE=M057B06;LINKAGE=A

MULTIPOLE AMPLITUDES IN $\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)$ RADIATIVE DECAY

NODE=M057240

$a_2 = M_2 / \sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11.0± 1.0 OUR AVERAGE				

NODE=M057A1
NODE=M057A1

-12.0± 1.3±0.4	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
- 9.3± 1.6±0.3	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
- 9.3 ⁺ _{4.1} 3.9±0.6	5.9k	³ AMBROGIANI	02 E835	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-14 ± 6	1.9k	³ ARMSTRONG	93E E760	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-33.3 ⁺ _{-29.2} 11.6	441	³ OREGLIA	82 CBAL	$\psi(2S) \rightarrow \chi_{c1}\gamma \rightarrow J/\psi\gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

- 7.9± 1.9±0.3	19.8k	⁴ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
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¹ Correlated with a_3 , b_2 , and b_3 with correlation coefficients $\rho_{a_2 a_3} = 0.733$, $\rho_{a_2 b_2} = -0.605$, and $\rho_{a_2 b_3} = -0.095$.

OCCUR=2

NODE=M057A1;LINKAGE=B

² From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

³ Assuming $a_3=0$.

⁴ From a fit with floating M_2 and E_3 amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A1;LINKAGE=AR
NODE=M057A1;LINKAGE=A
NODE=M057A1;LINKAGE=AT

$a_3 = E_3 / \sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-0.3±1.0 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.

NODE=M057A2
NODE=M057A2

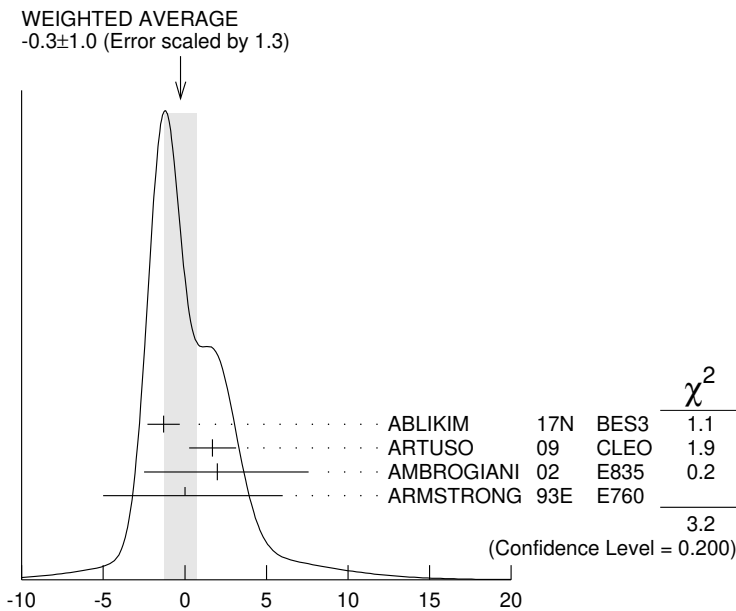
-1.3±0.9±0.4	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
1.7±1.4±0.3	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.0 ⁺ _{-4.4} 5.5±0.9	5908	AMBROGIANI	02 E835	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0 ⁺ ₋₅ 6	1904	ARMSTRONG	93E E760	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$

¹ Correlated with a_2 , b_2 , and b_3 with correlation coefficients $\rho_{a_2 a_3} = 0.733$, $\rho_{a_3 b_2} = -0.422$, and $\rho_{a_3 b_3} = -0.024$.

NODE=M057A2;LINKAGE=A

² From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057A2;LINKAGE=AR



$a_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude (units 10^{-2})

MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

NODE=M057250

$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M057QB2
NODE=M057QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.9 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1.7±0.8±0.2	89k	1 ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
4.6±1.0±1.3	13.8k	2 ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+ K^-$
0.2±1.5±0.4	19.8k	3 ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
- 5.1 ^{+5.4} _{-3.6}	721	2 ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+ K^-$
13.2 ^{+9.8} _{-7.5}	441	4 OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.0±1.3±0.3 19.8k 4 ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Correlated with a_2 , a_3 , and b_3 with correlation coefficients $\rho_{a_2 b_2} = -0.605$, $\rho_{a_3 b_2} = -0.422$, and $\rho_{b_2 b_3} = 0.384$.

NODE=M057QB2;LINKAGE=A

² From a fit with floating $M2$ and $E3$ amplitudes b_2 and b_3 .

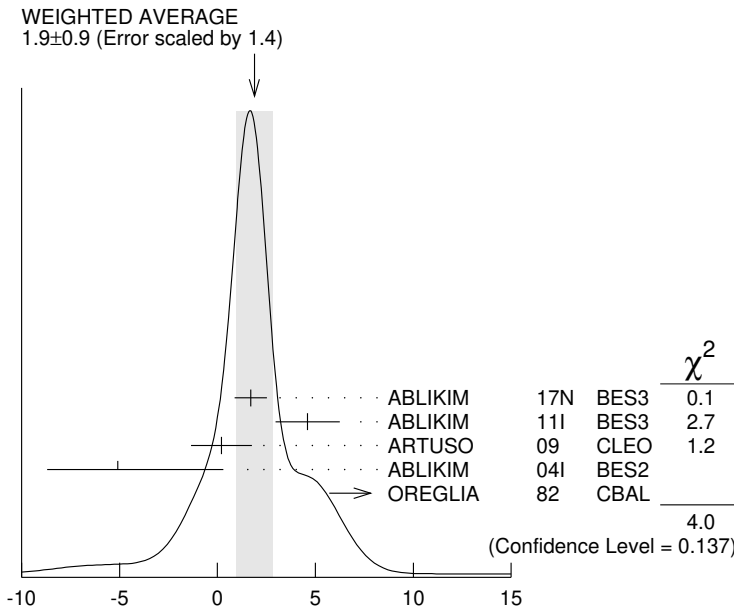
NODE=M057QB2;LINKAGE=AB

³ From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .

NODE=M057QB2;LINKAGE=AT

⁴ From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ amplitudes $a_3=b_3=0$.

NODE=M057QB2;LINKAGE=AR



$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude (units 10^{-2})

$b_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-1.0±0.6 OUR AVERAGE				
-1.4±0.7±0.4	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
1.5±0.8±1.8	13.8k	² ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
-0.8±1.2±0.2	19.8k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-2.7 ^{+4.3} _{-2.9}	721	² ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$

¹ Correlated with a_2 , a_3 , and b_2 with correlation coefficients $\rho_{a_2 b_3} = -0.095$, $\rho_{a_3 b_3} = -0.024$, and $\rho_{b_2 b_3} = 0.384$.

² From a fit with floating $M2$ and $E3$ amplitudes b_2 and b_3 .

NODE=M057QB3
NODE=M057QB3

NODE=M057QB3;LINKAGE=A

NODE=M057QB3;LINKAGE=AB

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ and $\chi_{c2} \rightarrow \gamma J/\psi(1S)$

NODE=M057260

b_2/a_2 Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11⁺¹⁴ -15	19.8k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M057QAR
NODE=M057QAR

¹ Statistical and systematic errors combined. From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ amplitudes $a_3=b_3=0$. Not independent of values for $a_2(\chi_{c2}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M057QAR;LINKAGE=AR

$\chi_{c2}(1P)$ REFERENCES

NODE=M057

ABLIKIM	24AC	PR D110 032016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62682
ABLIKIM	24BE	PR D110 032022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62904
ABLIKIM	24BT	PR D110 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63025
ABLIKIM	24BW	PR D110 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63028
ABLIKIM	24BX	PR D110 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63029
ABLIKIM	24CA	PR D110 112013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63032
ABLIKIM	24P	PR D109 072016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62667
ABLIKIM	23N	JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM	23T	PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
SEINO	23	JHEP 2301 160	Y. Seino <i>et al.</i>	(BELLE Collab.)	REFID=62051
ABLIKIM	22AO	PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM	22O	JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AV	JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026

ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
AAIJ	17BI	PRL 119 221801	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58278
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310
ABLIKIM	17AG	PR D96 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58316
ABLIKIM	17AI	PR D96 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58321
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56779
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54266
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11I	PR D84 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53930
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
ABLIKIM	10A	PR D81 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53347
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52721
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
DOBBS	06	PR D73 071101	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=51062
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ABLIKIM	04I	PR D70 092004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50189
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE	02T	PL B540 33	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=48813
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48552
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
ACCIARRI	99E	PL B453 73	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46943
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ACKER...K...	98	PL B439 197	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46324
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
DOMINICK	94	PR D50 4265	J. Dominick <i>et al.</i>	(CLEO Collab.)	REFID=44077
ARMSTRONG	93	PRL 70 2988	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43306
ARMSTRONG	93E	PR D48 3037	T.A. Armstrong <i>et al.</i>	(FNAL-E760 Collab.)	REFID=48616
BAUER	93	PL B302 345	D.A. Bauer <i>et al.</i>	(TPC Collab.)	REFID=43315
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BAGLIN	86B	PL B172 455	C. Baglin (LAPP, CERN, GENO, LYON, OSLO+)		REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
BARATE	81	PR D24 2994	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, CERN+)	REFID=22164
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151

$$J^G(J^{PC}) = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

NEW

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3637.8 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.1. [3637.7 ± 0.9 MeV OUR 2024 AVERAGE Scale factor = 1.2]		
3637.8 ± 0.8 ± 0.2	1.6k	ABLIKIM	24J BES3	$\psi(2S) \rightarrow \gamma \eta_c \rightarrow \gamma K \bar{K} \pi$
3637.90 ± 0.54 ± 1.40	3.7k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+ (K_S^0 K \pi)$
3643.4 ± 2.3 ± 4.4	569	ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
3635.1 ± 3.7 ± 2.9	106	XU	18 BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
3633.6 ± 1.7 ± 0.6	106	¹ AAIJ	17AD LHCB	$p p \rightarrow B^+ X \rightarrow p \bar{p} K^+ X$
3636.4 ± 4.1 ± 0.7	365	² AAIJ	17BB LHCB	$p p \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$
3637.0 ± 5.7 ± 3.4	178	^{3,4} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^0$
3635.1 ± 5.8 ± 2.1	47	^{3,5} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \eta$
3646.9 ± 1.6 ± 3.6	57	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6 ± 2.9 ± 1.6	127	⁶ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
3638.5 ± 1.5 ± 0.8	624	³ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 ± 3.2 ± 2.5	1201	³ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
3636.1 ^{+3.9} _{-4.2} ^{+0.7} _{-2.0}	128	⁷ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 ± 5 ± 6	311	⁸ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi (c \bar{c})$
3645.0 ± 5.5 ^{+4.9} _{-7.8}	121	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c \bar{c}$
3642.9 ± 3.1 ± 1.5	61	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3639 ± 7	98	⁹ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
3630.8 ± 3.4 ± 1.0	112	¹⁰ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
3654 ± 6 ± 8	39	¹¹ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ± 5		¹² EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹AAIJ 17AD report $m_{\psi(2S)} - m_{\eta_c(2S)} = 52.5 \pm 1.7 \pm 0.6$ MeV. We use the current value $m_{\psi(2S)} = 3686.097 \pm 0.025$ MeV to obtain the quoted mass.

²From a fit of the $\phi\phi$ invariant mass with the width of $\eta_c(2S)$ fixed to the PDG 16 value.

³Ignoring possible interference with continuum.

⁴With a width fixed to 11.3 MeV.

⁵With a width fixed to 11.3 MeV. Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁶From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

⁷Accounts for interference with non-resonant continuum.

⁸From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

⁹From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁰Superseded by DEL-AMO-SANCHEZ 11M.

¹¹Superseded by VINOKUROVA 11.

¹²Assuming mass of $\psi(2S) = 3686$ MeV.

NODE=M059M;LINKAGE=B

NODE=M059M;LINKAGE=C

NODE=M059M;LINKAGE=DE

NODE=M059M;LINKAGE=LE

NODE=M059M;LINKAGE=LS

NODE=M059M;LINKAGE=AB

NODE=M059M;LINKAGE=VA

NODE=M059M;LINKAGE=EB

NODE=M059M;LINKAGE=AU

NODE=M059M;LINKAGE=AR

NODE=M059M;LINKAGE=CH

NODE=M059M;LINKAGE=A

$\eta_c(2S)$ WIDTH

NODE=M059W

NODE=M059W

NEW

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
11.6 ± 1.4 OUR AVERAGE		[11.8 ± 1.6 MeV OUR 2024 AVERAGE]		
10.5 ± 1.7 ± 3.5	1.6k	ABLIKIM	24J BES3	$\psi(2S) \rightarrow \gamma \eta_c \rightarrow \gamma K \bar{K} \pi$
10.77 ± 1.62 ± 1.08	3.7k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+ (K_S^0 K \pi)$
19.8 ± 3.9 ± 3.1	569	ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
9.9 ± 4.8 ± 2.9	57	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$

$16.9 \pm 6.4 \pm 4.8$	127	¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi,$ $K K \pi^0$
$13.4 \pm 4.6 \pm 3.2$	624	² DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
$6.6 \begin{smallmatrix} + 8.4 & +2.6 \\ - 5.1 & -0.9 \end{smallmatrix}$	128	³ VINOKUROVA 11	BELL	$B^\pm \rightarrow$ $K^\pm (K_S^0 K^\pm \pi^\mp)$
$6.3 \pm 12.4 \pm 4.0$	61	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow$ $K_S^0 K^\pm \pi^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 23	90	98	⁴ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
22 ± 14		121	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c\bar{c}$
$17.0 \pm 8.3 \pm 2.5$	112		⁵ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow$ $K\bar{K}\pi$
< 55	90	39	⁶ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
< 8.0	95		⁷ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

² Ignoring possible interference with continuum.

³ Accounts for interference with non-resonant continuum.

⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁵ Superseded by DEL-AMO-SANCHEZ 11M.

⁶ For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.

⁷ For a mass value of 3594 ± 5 MeV

NODE=M059W;LINKAGE=AB
 NODE=M059W;LINKAGE=DE
 NODE=M059W;LINKAGE=VA
 NODE=M059W;LINKAGE=AU
 NODE=M059W;LINKAGE=AR
 NODE=M059W;LINKAGE=W2
 NODE=M059W;LINKAGE=W

$\eta_c(2S)$ DECAY MODES

NODE=M059215;NODE=M059

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	seen	
Γ_2 $K\bar{K}\pi$	$(1.9^{+1.2}_{-1.0})\%$	
Γ_3 $K\bar{K}\eta$	$(7^{+5}_{-4}) \times 10^{-3}$	
Γ_4 $2\pi^+ 2\pi^-$	$< 2.7 \times 10^{-4}$	90%
Γ_5 $a_0(1450)\pi$	seen	
Γ_6 $a_2(1700)\pi$	seen	
Γ_7 $a_0(1710)\pi$	seen	
Γ_8 $\rho^0 \rho^0$	$< 2.3 \times 10^{-3}$	90%
Γ_9 $3\pi^+ 3\pi^-$	$(1.7^{+0.9}_{-1.1})\%$	
Γ_{10} $K^+ K^- \pi^+ \pi^-$	$< 2.1 \times 10^{-4}$	90%
Γ_{11} $K^{*0} \bar{K}^{*0}$	$< 4 \times 10^{-3}$	90%
Γ_{12} $K^+ K^- \pi^+ \pi^- \pi^0$	$(1.3^{+0.8}_{-0.9}) \times 10^{-3}$	
Γ_{13} $K^+ K^- 2\pi^+ 2\pi^-$	$< 1.8\%$	90%
Γ_{14} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	$(1.4^{+0.8}_{-1.0})\%$	
Γ_{15} $2K^+ 2K^-$	$< 1.2 \times 10^{-4}$	90%
Γ_{16} $K_2^*(1430)\bar{K} + \text{c.c.}$	seen	
Γ_{17} $K_0^*(1950)\bar{K} + \text{c.c.}$	seen	
Γ_{18} $K_0^*(2600)\bar{K} + \text{c.c.}$	seen	
Γ_{19} $\phi\phi$	$< 1.4 \times 10^{-3}$	90%
Γ_{20} $p\bar{p}$	$< 2.7 \times 10^{-5}$	90%
Γ_{21} $p\bar{p}\pi^+ \pi^-$	seen	
Γ_{22} $\gamma\gamma$	$(2.0^{+1.3}_{-1.1}) \times 10^{-3}$	
Γ_{23} $\gamma J/\psi(1S)$	$< 1.8\%$	90%
Γ_{24} $\pi^+ \pi^- \eta$	$(5.5^{+3.3}_{-4.0}) \times 10^{-3}$	
Γ_{25} $\pi^+ \pi^- \eta'$	$(2.4^{+1.5}_{-1.7}) \times 10^{-4}$	
Γ_{26} $\pi^+ \pi^- \eta_c(1S)$	$< 6 \times 10^{-3}$	90%

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=4

DESIG=20

DESIG=5

DESIG=27

DESIG=28

DESIG=26

DESIG=16

DESIG=8

DESIG=6

DESIG=17

DESIG=9

DESIG=10

DESIG=11

DESIG=7

DESIG=24

DESIG=25

DESIG=29

DESIG=18

DESIG=3

DESIG=22

DESIG=2

DESIG=21

DESIG=12

DESIG=13

DESIG=15

FIT INFORMATION

A multiparticle fit to $\eta_c(2S)$ and $\psi(2S)$ with a combination of partial widths obtained from integrated cross sections and 4 branching ratios uses 7 measurements to determine 4 parameters. The overall fit has a $\chi^2 = 2.9$ for 3 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_3	92	
x_{22}	-97	-90
	x_2	x_3

$\eta_c(2S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$	Γ_{22}
VALUE (keV)	NODE=M059216
EVTS	NODE=M059W1
DOCUMENT ID	NODE=M059W1
TECN	
COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.44 ± 0.14	106	¹ XU	18	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
1.3 ± 0.6		² ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹ Assuming that the branching fraction into $\eta'\pi^+\pi^-$ is the same as for $\eta_c(1S)$.

² They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S^0 K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.

NODE=M059216

NODE=M059W1
NODE=M059W1NODE=M059W1;LINKAGE=A
NODE=M059W1;LINKAGE=AS

$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059218
EVTS	NODE=M059G04
DOCUMENT ID	NODE=M059G04
TECN	
COMMENT	

39 ± 6 OUR FIT

39 ± 6 OUR AVERAGE

[41 ± 7 eV OUR 2024 AVERAGE]

41 ± 4 ± 6	624	DEL-AMO-SA..11M	BABR	BELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
33.6 ± 7.2 ± 8.1		¹ NAKAZAWA	08	BELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹ NAKAZAWA 08 reports $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp) \times \Gamma(\gamma\gamma) = 11.2 \pm 2.4 \pm 2.7$ eV which we multiplied by 3 to account for isospin symmetry.

NODE=M059218

NODE=M059G04
NODE=M059G04

NEW

NODE=M059G04;LINKAGE=A

$\Gamma(2\pi^+2\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_4\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059G01
CL%	NODE=M059G01
DOCUMENT ID	
TECN	
COMMENT	

<6.5	90	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+\pi^-)$
----------------	----	--------	----	------	---

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059G02
CL%	NODE=M059G02
DOCUMENT ID	
TECN	
COMMENT	

<5.0	90	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+K^-\pi^+\pi^-$
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$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{12}\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059G05
EVTS	NODE=M059G05
DOCUMENT ID	
TECN	
COMMENT	

30 ± 6 ± 5	1201	DEL-AMO-SA..11M	BABR	BELL	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
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$\Gamma(2K^+2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{15}\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059G03
CL%	NODE=M059G03
DOCUMENT ID	
TECN	
COMMENT	

<2.9	90	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+K^-)$
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$\Gamma(\pi^+\pi^-\eta') \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{25}\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059R29
EVTS	NODE=M059R29
DOCUMENT ID	
TECN	
COMMENT	

5.6^{+1.2}_{-1.1} ± 1.1	106	XU	18	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
--	-----	----	----	------	--

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{26}\Gamma_{22}/\Gamma$
VALUE (eV)	NODE=M059G06
CL%	NODE=M059G06
DOCUMENT ID	
TECN	
COMMENT	

<133	90	LEES	12AE	BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$
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$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma^2(\text{total})$ $\Gamma(\bar{p}p)/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-8})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90	1,2,3 AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8.0	90	1,2,4 AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
< 12.0	90	2,4 AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

¹ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.² For a total width $\Gamma=5$ MeV.³ For the resonance mass region 3589–3599 MeV/ c^2 .⁴ For the resonance mass region 3575–3660 MeV/ c^2 .

NODE=M059217

NODE=M059G1
NODE=M059G1

OCCUR=2

OCCUR=3

NODE=M059G1;LINKAGE=A

NODE=M059G1;LINKAGE=B

NODE=M059G1;LINKAGE=C1

NODE=M059G1;LINKAGE=C2

 $\eta_c(2S)$ BRANCHING RATIOS $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABREU 98O	DLPH	$e^+e^- \rightarrow e^+e^- + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	¹ EDWARDS 82C	CBAL	$e^+e^- \rightarrow \gamma X$

¹ For a mass value of 3594 ± 5 MeV

NODE=M059220

NODE=M059R1
NODE=M059R1

NODE=M059R;LINKAGE=W

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.9^{+1.2}_{-1.0} OUR FIT**1.9 \pm 0.4 \pm 1.1** 59 \pm 12 ¹AUBERT 08AB BABR $B \rightarrow \eta_c(2S)K \rightarrow K\bar{K}\pi K$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	127 \pm 18	ABLIKIM 12G	BES3	$\psi(2S) \rightarrow \gamma K\bar{K}\pi$
seen	39 \pm 11	² CHOI 02	BELL	$B \rightarrow K K_S K^- \pi^+$

¹ Derived from a measurement of $[B(B^+ \rightarrow \eta_c(2S)K^+) \times B(\eta_c(2S) \rightarrow K\bar{K}\pi)] / [B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (9.6^{+2.0}_{-1.9} \pm 2.5)\%$ and using $B(B^+ \rightarrow \eta_c(2S)K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.² For a mass value of 3654 ± 6 MeVNODE=M059R3
NODE=M059R3

NODE=M059R3;LINKAGE=AU

NODE=M059R;LINKAGE=W2

 $\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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39 \pm 10 OUR FIT Error includes scale factor of 1.3.**27.3 \pm 7.0 \pm 9.0** 225 ¹LEES 14E BABR $\gamma\gamma \rightarrow K^+ K^- \gamma\gamma$ ¹ LEES 14E reports $B(\eta_c(2S) \rightarrow K^+ K^- \eta)/B(\eta_c(2S) \rightarrow K^+ K^- \pi^0) = 0.82 \pm 0.21 \pm 0.27$, which we divide by 3 to account for isospin symmetry.NODE=M059R26
NODE=M059R26

NODE=M059R26;LINKAGE=LE

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S)$ NODE=M059R01
NODE=M059R01 $\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ¹AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K\pi)$ ¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$.NODE=M059R38
NODE=M059R38

NODE=M059R38;LINKAGE=A

 $\Gamma(a_2(1700)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ¹AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K\pi)$ ¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$.NODE=M059R39
NODE=M059R39

NODE=M059R39;LINKAGE=A

 $\Gamma(a_0(1710)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen ¹AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K\pi)$ ¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$.NODE=M059R37
NODE=M059R37

NODE=M059R37;LINKAGE=A

$\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R15
NODE=M059R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ABLIKIM 11H BES3 $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

 $\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R02
NODE=M059R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S)$

 $\Gamma(K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R16
NODE=M059R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ABLIKIM 11H BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$ Γ_{12}/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M059R21
NODE=M059R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.73 \pm 0.17 \pm 0.17$ 1201 ¹ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M. We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$.

NODE=M059R21;LINKAGE=DE

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M059R22
NODE=M059R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 57 ± 17 ABLIKIM 13K BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$

 $\Gamma(2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R03
NODE=M059R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen UEHARA 08 BELL $\gamma\gamma \rightarrow \eta_c(2S)$

 $\Gamma(K_2^*(1430) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R34
NODE=M059R34

seen ¹ AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R34;LINKAGE=A

 $\Gamma(K_0^*(1950) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R35
NODE=M059R35

seen ¹ AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R35;LINKAGE=A

 $\Gamma(K_0^*(2600) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R40
NODE=M059R40

seen ¹ AAIJ 23AH LHCB $B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R40;LINKAGE=A

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M059R17
NODE=M059R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ABLIKIM 11H BES3 $\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M059R04
NODE=M059R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 106 ¹ AAIJ 17AD LHCB $p\bar{p} \rightarrow B^+ X \rightarrow p\bar{p}K^+ X$

OCCUR=2

¹ AAIJ 17AD report a 6.4 standard deviation signal, with $B(B^+ \rightarrow \eta_c(2S) K^+ \rightarrow p\bar{p}K^+)/B(B^+ \rightarrow J/\psi K^+ \rightarrow p\bar{p}K^+) = (1.58 \pm 0.33 \pm 0.09) \times 10^{-2}$.

NODE=M059R04;LINKAGE=A

$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	110	¹ CHILIKIN	19	BELL $e^+e^- \rightarrow \Upsilon(4S)$
¹ CHILIKIN 19 reports signals in $B^+ \rightarrow \eta_c(2S)K^+$ and $B^0 \rightarrow \eta_c(2S)K_S^0$ with 12.3 and 5.9 standard deviations, respectively.				

NODE=M059R30
NODE=M059R30

NODE=M059R30;LINKAGE=A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<4 × 10 ⁻⁴	90	¹ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$
not seen		AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$
<0.01	90	LEE	85	CBAL $\psi' \rightarrow \text{photons}$
¹ WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S)K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S)K^+) = 4.4 \times 10^{-4}$.				

NODE=M059R2
NODE=M059R2

NODE=M059R2;LINKAGE=WI

 $\Gamma(\pi^+\pi^-\eta_c(1S))/\Gamma(K\bar{K}\pi)$ Γ_{26}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.33	90	¹ LEES	12AE	BABR $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$
¹ We divided the reported limit by 3 to take into account isospin relations.				

NODE=M059R23
NODE=M059R23

NODE=M059R23;LINKAGE=LE

 $\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

 $\Gamma(\eta_c(2S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT
1.03 ± 0.12 OUR FIT		Error includes scale factor of 1.2.		
1.00 ± 0.10 OUR AVERAGE				
0.97 ± 0.06 ± 0.09	1.6k	ABLIKIM	24J	BES3 $\psi(2S) \rightarrow \gamma\eta_c \rightarrow \gamma K\bar{K}\pi$
1.30 ± 0.20 ± 0.30	127	ABLIKIM	12G	BES3 $\psi(2S) \rightarrow \gamma\eta_c \rightarrow \gamma K\bar{K}\pi$

NODE=M059R42
NODE=M059R42 $\Gamma(\eta_c(2S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE (units 10 ⁻⁶)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 1.0 OUR FIT		Error includes scale factor of 1.3.			
4.78 ± 0.64 ± 0.68	362	¹ ABLIKIM	24BWBES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<11.8	90	² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$	
¹ ABLIKIM 24BW reports a value of $(2.39 \pm 0.32 \pm 0.34) \times 10^{-6}$ for the decay $\eta_c(2S) \rightarrow K^+ K^- \eta$ which we multiply by 2 to account for isospin symmetry.					
² CRONIN-HENNESSY 10 reports a limit of $< 5.9 \times 10^{-6}$ for the decay $\eta_c(2S) \rightarrow K^+ K^- \eta$ which we multiply by 2 account for isospin symmetry. It assumes $\Gamma(\eta_c(2S)) = 14$ MeV. It also gives the analytic dependence of limits on width.					

NODE=M059R25
NODE=M059R25

NODE=M059R25;LINKAGE=A

NODE=M059R25;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow 2\pi^+2\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.43 × 10⁻⁶ (CL = 90%)		[<1.46 × 10 ⁻⁵ (CL = 90%) OUR 2024 BEST LIMIT]		
< 1.43 × 10⁻⁶	90	ABLIKIM	24BT	BES3 $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<14.6 × 10 ⁻⁶	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$
¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.				

NODE=M059R05
NODE=M059R05

NODE=M059R05;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow \rho^0\rho^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 12.7 × 10⁻⁷	90	ABLIKIM	11H	BES3 $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R18
NODE=M059R18

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$9.2 \pm 1.0 \pm 1.2$		569	ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$

NODE=M059R06
NODE=M059R06

••• We do not use the following data for averages, fits, limits, etc. •••

<13.2	90		¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
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¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R06;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 9.6×10^{-6}	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R07
NODE=M059R07

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R07;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{11} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 19.6×10^{-7}	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R19
NODE=M059R19

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{12} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 43.0×10^{-6}	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059R08
NODE=M059R08

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{13} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 9.7×10^{-6}	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

NODE=M059R09
NODE=M059R09

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{14} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.9 ± 1.8		OUR AVERAGE			

[(7.0 ± 2.2) $\times 10^{-6}$ OUR 2024 AVERAGE]

$9.31 \pm 0.72 \pm 2.77$	3140	ABLIKIM	24Q BES3	$\psi(2S) \rightarrow$	$\gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$
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$7.03 \pm 2.10 \pm 0.7$	60	ABLIKIM	13K BES3	$\psi(2S) \rightarrow$	$\gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$
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••• We do not use the following data for averages, fits, limits, etc. •••

< 15.2	90		¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow$	$\gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$
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¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{19} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 7.8×10^{-7}	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R20
NODE=M059R20

$$\Gamma(\eta_c(2S) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{20} / \Gamma \times \Gamma_{185}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4×10^{-6}	90	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M059R24
NODE=M059R24

$$\Gamma(\eta_c(2S) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{23}/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$

¹ Uses $B(J/\psi \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.

NODE=M059R27
NODE=M059R27

NODE=M059R27;LINKAGE=A

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{24}/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.97 \pm 0.81 \pm 0.26$		106	ABLIKIM	23Q BES3	$\psi(2S) \rightarrow \gamma \pi^+\pi^-\eta$
<4.3	90		¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+\pi^-\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11
NODE=M059R11

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{25}/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+\pi^-\eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12
NODE=M059R12

NODE=M059R12;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{26}/\Gamma \times \Gamma_{185}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.21 \times 10^{-5}$ (CL = 90%)		[$<1.7 \times 10^{-4}$ (CL = 90%) OUR 2024 BEST LIMIT]		
$<2.21 \times 10^{-5}$	90	¹ ABLIKIM	24Q BES3	$\psi(2S) \rightarrow \gamma \pi^+\pi^-\eta_c(1S)$
$<1.7 \times 10^{-4}$	90	² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+\pi^-\eta_c(1S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ $\eta_c(1S)$ reconstructed in the final states $K^+K^-\pi^0$ and $K_S^0K^\pm\pi^\mp$.

² Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

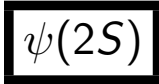
NODE=M059R14
NODE=M059R14

NODE=M059R14;LINKAGE=A
NODE=M059R14;LINKAGE=CR

$\eta_c(2S)$ REFERENCES

ABLIKIM	24BT PR D110 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63025
ABLIKIM	24BW PR D110 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63028
ABLIKIM	24J PR D109 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62660
ABLIKIM	24Q PR D109 072017	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62668
AAIJ	23AH PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	23Q PR D107 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62060
ABLIKIM	22Q PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
CHILIKIN	19 PR D100 012001	K. Chilikin <i>et al.</i>	(BELLE Collab.)	REFID=59899
XU	18 PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE Collab.)	REFID=59453
AAIJ	17AD PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
AAIJ	17BB EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
ABLIKIM	17N PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
PDG	16 CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
LEES	14E PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937
ABLIKIM	13K PR D87 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54956
ABLIKIM	13V PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
ABLIKIM	12G PRL 109 042003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54272
LEES	12AE PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
ABLIKIM	11H PR D84 091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53929
DEL-AMO-SA...	11M PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA	11 PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
CRONIN-HEN...	10 PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=53233
AUBERT	08AB PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
NAKAZAWA	08 NPBS 184 220	H. Nakazawa	(BELLE Collab.)	REFID=63007
UEHARA	08 EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08 PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07 PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
AUBERT	06E PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
AUBERT	05C PR D72 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50773
ABE	04G PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ASNER	04 PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT	04D PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
ABE,K	02 PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
CHOI	02 PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=48760
AMBROGIANI	01 PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48340
ABREU	98O PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46553
ARMSTRONG	95F PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=44623
LEE	85 SLAC 282	R.A. Lee	(SLAC)	REFID=40589
EDWARDS	82C PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173

NODE=M059



$$I^G(J^{PC}) = 0^-(1^{--})$$

See the Review on "Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ " before the $\chi_{c0}(1P)$ Listings.

NODE=M071

NODE=M071

$\psi(2S)$ MASS

NODE=M071M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M071M

NODE=M071M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3686.097 ± 0.011 OUR FIT		Error includes scale factor of 1.1.		
3686.097 ± 0.010 OUR AVERAGE				
3686.099 ± 0.004 ± 0.009		¹ ANASHIN	15	KEDR $e^+e^- \rightarrow$ hadrons
3686.12 ± 0.06 ± 0.10	4k	AAIJ	12H	LHCB $pp \rightarrow J/\psi \pi^+ \pi^- X$
3685.95 ± 0.10	413	² ARTAMONOV	00	OLYA $e^+e^- \rightarrow$ hadrons
3685.98 ± 0.09 ± 0.04		³ ARMSTRONG	93B	E760 $\bar{p}p \rightarrow e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3686.08 ± 0.07	1301	⁴ AAIJ	23AP	LHCB $B_S^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$
3686.114 ± 0.007 ^{+0.011} _{-0.016}		⁵ ANASHIN	12	KEDR $e^+e^- \rightarrow$ hadrons
3686.111 ± 0.025 ± 0.009		AULCHENKO	03	KEDR $e^+e^- \rightarrow$ hadrons
3686.00 ± 0.10	413	⁶ ZHOLENTZ	80	OLYA e^+e^-

¹ Supersedes AULCHENKO 03 and ANASHIN 12.

² Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

³ Mass central value and systematic error recalculated by us according to Eq. (16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

⁴ From a fit of a relativistic S -wave Breit-Wigner convolved with the detector resolution. The width of $\psi(2S)$ is constrained to the PDG 22 value. Systematic errors not evaluated.

⁵ From the scans in 2004 and 2006. ANASHIN 12 reports the value $3686.114 \pm 0.007 \pm 0.011^{+0.002}_{-0.012}$ MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

⁶ Superseded by ARTAMONOV 00.

NODE=M071M;LINKAGE=A

NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=B

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=RZ

$m_{\psi(2S)} - m_{J/\psi(1S)}$

NODE=M071DM

NODE=M071DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
589.188 ± 0.028 OUR AVERAGE			
589.194 ± 0.027 ± 0.011	¹ AULCHENKO	03	KEDR $e^+e^- \rightarrow$ hadrons
589.7 ± 1.2	LEMOIGNE	82	GOLI $185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- \text{A}$
589.07 ± 0.13	¹ ZHOLENTZ	80	OLYA e^+e^-
588.7 ± 0.8	LUTH	75	MRK1
• • • We do not use the following data for averages, fits, limits, etc. • • •			
588 ± 1	² BAI	98E	BES e^+e^-

¹ Redundant with data in mass above.

² Systematic errors not evaluated.

NODE=M071DM;LINKAGE=R

NODE=M071DM;LINKAGE=BD

$\psi(2S)$ WIDTH

NODE=M071W

NODE=M071W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
293 ± 9 OUR FIT		Error includes scale factor of 1.2.		
286 ± 16 OUR AVERAGE				
358 ± 88 ± 4		ABLIKIM	08B	BES2 $e^+e^- \rightarrow$ hadrons
290 ± 25 ± 4	2.7k	ANDREOTTI	07	E835 $p\bar{p} \rightarrow e^+e^-, J/\psi X$
331 ± 58 ± 2		ABLIKIM	06L	BES2 $e^+e^- \rightarrow$ hadrons
264 ± 27		¹ BAI	02B	BES2 e^+e^-
287 ± 37 ± 16		² ARMSTRONG	93B	E760 $\bar{p}p \rightarrow e^+e^-$

¹ From a simultaneous fit to the hadronic and $\mu^+ \mu^-$ cross section, assuming $\Gamma = \Gamma_h + \Gamma_e + \Gamma_\mu + \Gamma_\tau$ and lepton universality. Does not include vacuum polarization correction.

² The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

NODE=M071W;LINKAGE=BC

NODE=M071W;LINKAGE=AN

$\psi(2S)$ DECAY MODES

NODE=M071220;NODE=M071

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 hadrons	(97.85 \pm 0.13) %		DESIG=3
Γ_2 virtual $\gamma \rightarrow$ hadrons	(1.79 \pm 0.04) %		DESIG=4
Γ_3 $g g g$	(10.6 \pm 1.6) %		DESIG=255
Γ_4 $\gamma g g$	(1.03 \pm 0.29) %		DESIG=256
Γ_5 light hadrons	(15.4 \pm 1.5) %		DESIG=226
Γ_6 K_S^0 anything	(16.0 \pm 1.1) %		DESIG=325
Γ_7 $e^+ e^-$	(7.94 \pm 0.22) $\times 10^{-3}$	S=1.3	DESIG=1
Γ_8 $\mu^+ \mu^-$	(8.0 \pm 0.6) $\times 10^{-3}$		DESIG=2
Γ_9 $\tau^+ \tau^-$	(3.1 \pm 0.4) $\times 10^{-3}$		DESIG=68
Decays into $J/\psi(1S)$ and anything			
Γ_{10} $J/\psi(1S)$ anything	(61.5 \pm 0.7) %	S=1.3	NODE=M071;CLUMP=A DESIG=11
Γ_{11} $J/\psi(1S)$ neutrals	(25.4 \pm 0.5) %	S=1.6	DESIG=12
Γ_{12} $J/\psi(1S) \pi^+ \pi^-$	(34.69 \pm 0.34) %	S=1.1	DESIG=13
Γ_{13} $J/\psi(1S) \pi^0 \pi^0$	(18.2 \pm 0.5) %	S=1.6	DESIG=14
Γ_{14} $J/\psi(1S) \eta$	(3.37 \pm 0.06) %	S=1.2	DESIG=15
Γ_{15} $J/\psi(1S) \pi^0$	(1.268 \pm 0.032) $\times 10^{-3}$		DESIG=18
Hadronic decays			
Γ_{16} $\pi^+ \pi^-$	(7.8 \pm 2.6) $\times 10^{-6}$		NODE=M071;CLUMP=B DESIG=21
Γ_{17} $\pi^+ \pi^- \pi^0$	(2.01 \pm 0.17) $\times 10^{-4}$	S=1.7	DESIG=36
Γ_{18} $\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	(3.2 \pm 1.2) $\times 10^{-5}$	S=1.8	DESIG=22
Γ_{19} $\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	(1.9 \pm 1.2 -0.4) $\times 10^{-4}$		DESIG=201
Γ_{20} $2(\pi^+ \pi^-)$	(2.4 \pm 0.6) $\times 10^{-4}$	S=2.2	DESIG=24
Γ_{21} $\rho^0 \pi^+ \pi^-$	(2.2 \pm 0.6) $\times 10^{-4}$	S=1.4	DESIG=33
Γ_{22} $2(\pi^+ \pi^-) \pi^0$	(2.9 \pm 1.0) $\times 10^{-3}$	S=4.7	DESIG=25
Γ_{23} $\rho a_2(1320)$	(2.6 \pm 0.9) $\times 10^{-4}$		DESIG=65
Γ_{24} $\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	(5.3 \pm 1.0) $\times 10^{-3}$		DESIG=312
Γ_{25} $\rho^\pm \pi^\mp \pi^0 \pi^0$	< 2.7 $\times 10^{-3}$	CL=90%	DESIG=315
Γ_{26} $\pi^+ \pi^- 4\pi^0$	(1.4 \pm 1.0) $\times 10^{-3}$		DESIG=332
Γ_{27} $3(\pi^+ \pi^-)$	(3.5 \pm 2.0) $\times 10^{-4}$	S=2.8	DESIG=32
Γ_{28} $2(\pi^+ \pi^- \pi^0)$	(4.8 \pm 1.5) $\times 10^{-3}$		DESIG=221
Γ_{29} $3(\pi^+ \pi^-) \pi^0$	(3.5 \pm 1.6) $\times 10^{-3}$		DESIG=37
Γ_{30} $2(\pi^+ \pi^-) 3\pi^0$	(1.42 \pm 0.31) %		DESIG=329
Γ_{31} $\eta \pi^+ \pi^-$	< 1.6 $\times 10^{-4}$	CL=90%	DESIG=202
Γ_{32} $\eta \pi^+ \pi^- \pi^0$	(9.5 \pm 1.7) $\times 10^{-4}$		DESIG=203
Γ_{33} $\eta 2(\pi^+ \pi^-)$	(1.2 \pm 0.6) $\times 10^{-3}$		DESIG=251
Γ_{34} $\eta \pi^+ \pi^- \pi^0 \pi^0$	< 4 $\times 10^{-4}$	CL=90%	DESIG=313
Γ_{35} $\eta \pi^+ \pi^- 3\pi^0$	< 2.1 $\times 10^{-3}$	CL=90%	DESIG=334
Γ_{36} $\eta 2(\pi^+ \pi^- \pi^0)$	< 2.1 $\times 10^{-3}$	CL=90%	DESIG=328
Γ_{37} $\rho \eta$	(2.2 \pm 0.6) $\times 10^{-5}$	S=1.1	DESIG=94
Γ_{38} $\eta' \pi^+ \pi^- \pi^0$	(4.5 \pm 2.1) $\times 10^{-4}$		DESIG=204
Γ_{39} $\eta' \rho$	(1.9 \pm 1.7 -1.2) $\times 10^{-5}$		DESIG=93
Γ_{40} $\omega \pi^0$	(2.1 \pm 0.6) $\times 10^{-5}$		DESIG=92
Γ_{41} $\omega \pi^+ \pi^-$	(7.3 \pm 1.2) $\times 10^{-4}$	S=2.1	DESIG=75
Γ_{42} $\omega \pi^+ \pi^- 2\pi^0$	(8.7 \pm 2.4) $\times 10^{-3}$		DESIG=327
Γ_{43} $b_1^\pm \pi^\mp$	(4.0 \pm 0.6) $\times 10^{-4}$	S=1.1	DESIG=40
Γ_{44} $\omega f_2(1270)$	(2.2 \pm 0.4) $\times 10^{-4}$		DESIG=64
Γ_{45} $\omega \pi^0 \pi^0$	(1.11 \pm 0.35) $\times 10^{-3}$		DESIG=314
Γ_{46} $\omega 3\pi^0$	< 8 $\times 10^{-4}$	CL=90%	DESIG=333
Γ_{47} $b_1^0 \pi^0$	(2.4 \pm 0.6) $\times 10^{-4}$		DESIG=193
Γ_{48} $\omega \eta$	< 1.1 $\times 10^{-5}$	CL=90%	DESIG=95
Γ_{49} $\omega \eta'$	(3.2 \pm 2.5 -2.1) $\times 10^{-5}$		DESIG=91
Γ_{50} $\phi \pi^0$	< 4 $\times 10^{-7}$	CL=90%	DESIG=96
Γ_{51} $\phi \pi^+ \pi^-$	(1.18 \pm 0.26) $\times 10^{-4}$	S=1.5	DESIG=78
Γ_{52} $\phi f_0(980) \rightarrow \pi^+ \pi^-$	(7.5 \pm 3.3) $\times 10^{-5}$	S=1.6	DESIG=81

Г53	$\phi\eta$	$(3.10 \pm 0.31) \times 10^{-5}$		DESIG=89
Г54	$\eta\phi(2170), \phi(2170) \rightarrow$ $\phi f_0(980), f_0 \rightarrow \pi^+\pi^-$	$< 2.2 \times 10^{-6}$	CL=90%	DESIG=316
Г55	$\phi\eta'$	$(1.54 \pm 0.20) \times 10^{-5}$		DESIG=90
Г56	$\phi\phi\phi$	$(1.46 \pm 0.18) \times 10^{-5}$		DESIG=354
Г57	$\phi f_1(1285)$	$(3.0 \pm 1.3) \times 10^{-5}$		DESIG=319
Г58	$\phi\eta(1405) \rightarrow \phi\pi^+\pi^-\eta$	$(8.5 \pm 1.7) \times 10^{-6}$		DESIG=320
Г59	$\phi f'_2(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Г60	K^+K^-	$(7.5 \pm 0.5) \times 10^{-5}$		DESIG=23
Г61	$K^+K^-\pi^+\pi^-$	$(7.3 \pm 0.5) \times 10^{-4}$		DESIG=26
Г62	$K^+K^-\pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		DESIG=38
Г63	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86
Г64	$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		DESIG=85
Г65	$K_S^0 K_L^0 \pi^0$	$< 3.0 \times 10^{-4}$	CL=90%	DESIG=303
Г66	$K^+K^-\pi^0\pi^0$	$(2.6 \pm 1.3) \times 10^{-4}$		DESIG=298
Г67	$K^+K^-\pi^0\pi^0\pi^0$	$(6.6 \pm 2.8) \times 10^{-4}$		DESIG=341
Г68	$K_S^0 K^\pm \pi^\mp \pi^0 \pi^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=342
Г69	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-3}$		DESIG=343
Г70	$K^+K^-\pi^+\pi^-\pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		DESIG=206
Г71	$\omega f_0(1710) \rightarrow \omega K^+K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		DESIG=216
Г72	$K^*(892)^0 K^-\pi^+\pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		DESIG=217
Г73	$K^*(892)^+ K^-\pi^+\pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		DESIG=218
Г74	$K^*(892)^+ K^-\rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		DESIG=219
Г75	$K^*(892)^0 K^-\rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=220
Г76	$K_S^0 K_S^0 \pi^+\pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=225
Г77	$K_S^0 K_L^0 \pi^0 \pi^0$	$(1.3 \pm 0.6) \times 10^{-3}$		DESIG=304
Г78	$K_S^0 K^*(892)^0 \pi^0 \pi^0$	$(3.0 \pm 1.3) \times 10^{-4}$		DESIG=348
Г79	$K_S^0 K^\pm \rho(770)^\mp \pi^0$	$< 7 \times 10^{-4}$	CL=90%	DESIG=352
Г80	$K_S^0 K^\pm \pi^\mp \rho(770)^0$	$< 7 \times 10^{-4}$	CL=90%	DESIG=353
Г81	$K^\mp K^*(892)^\pm \pi^0 \pi^0$	$(7.0 \pm 2.9) \times 10^{-4}$		DESIG=349
Г82	$K^*(892)^+ K^*(892)^- \pi^0$	$(3.6 \pm 1.8) \times 10^{-3}$		DESIG=350
Г83	$K_S^0 K_L^0 \eta$	$(1.3 \pm 0.5) \times 10^{-3}$		DESIG=305
Г84	$K^+K^-\rho^0$	$(2.2 \pm 0.4) \times 10^{-4}$		DESIG=205
Г85	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=66
Г86	$K^+K^-\pi^+\pi^-\eta$	$(1.3 \pm 0.7) \times 10^{-3}$		DESIG=252
Г87	$K^+K^-\pi^+\pi^-$	$(1.9 \pm 0.9) \times 10^{-3}$		DESIG=222
Г88	$K^+K^-\pi^+\pi^-\pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		DESIG=240
Г89	$K^+K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=39
Г90	$2(K^+K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$		DESIG=208
Г91	$2(K^+K^-)\pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Г92	$K^+K^-\phi$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Г93	$K_S^0 K_S^0 \phi$	$(3.53 \pm 0.29) \times 10^{-5}$		DESIG=347
Г94	$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		DESIG=41
Г95	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		DESIG=34
Г96	$\eta K^+K^-, \text{ no } \eta\phi$	$(3.49 \pm 0.17) \times 10^{-5}$		DESIG=207
Г97	ηK^+K^-	$< 2.6 \times 10^{-4}$	CL=90%	DESIG=351
Г98	$X(1750)\eta \rightarrow K^+K^-\eta$	$(4.8 \pm 2.8) \times 10^{-6}$		DESIG=324
Г99	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Г100	$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm_{-0.9}^{1.3}) \times 10^{-5}$		DESIG=265
Г101	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Г102	ωK^+K^-	$(1.62 \pm 0.11) \times 10^{-4}$	S=1.1	DESIG=76
Г103	$\omega K_S^0 K_S^0$	$(7.0 \pm 0.5) \times 10^{-5}$		DESIG=330
Г104	$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \pm 0.26) \times 10^{-4}$		DESIG=276
Г105	$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \pm 1.2) \times 10^{-5}$		DESIG=277
Г106	$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$		DESIG=278
Г107	$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		DESIG=279
Г108	$\omega X(1440) \rightarrow \omega K_S^0 K^-\pi^+ +$ c.c.	$(1.6 \pm 0.4) \times 10^{-5}$		DESIG=282

Γ_{109}	$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		DESIG=283
Γ_{110}	$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ +$ c.c.	$(3.0 \pm 1.0) \times 10^{-6}$		DESIG=284
Γ_{111}	$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$		DESIG=285
Γ_{112}	$\rho \bar{\rho}$	$(2.94 \pm 0.09) \times 10^{-4}$	S=1.3	DESIG=27
Γ_{113}	$n \bar{n}$	$(3.06 \pm 0.15) \times 10^{-4}$		DESIG=309
Γ_{114}	$\rho \bar{\rho} \pi^0$	$(1.53 \pm 0.07) \times 10^{-4}$		DESIG=35
Γ_{115}	$N(940) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(6.4 \pm_{-1.3}^{+1.8}) \times 10^{-5}$		DESIG=267
Γ_{116}	$N(1440) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(7.3 \pm_{-1.5}^{+1.7}) \times 10^{-5}$	S=2.5	DESIG=261
Γ_{117}	$N(1520) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(6.4 \pm_{-1.8}^{+2.3}) \times 10^{-6}$		DESIG=268
Γ_{118}	$N(1535) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(2.5 \pm 1.0) \times 10^{-5}$		DESIG=269
Γ_{119}	$N(1650) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(3.8 \pm_{-1.7}^{+1.4}) \times 10^{-5}$		DESIG=270
Γ_{120}	$N(1720) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(1.79 \pm_{-0.70}^{+0.26}) \times 10^{-5}$		DESIG=271
Γ_{121}	$N(2300) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(2.6 \pm_{-0.7}^{+1.2}) \times 10^{-5}$		DESIG=272
Γ_{122}	$N(2570) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \pi^0$	$(2.13 \pm_{-0.31}^{+0.40}) \times 10^{-5}$		DESIG=273
Γ_{123}	$\rho \bar{\rho} \pi^+ \pi^-$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Γ_{124}	$\rho \bar{\rho} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Γ_{125}	$\rho \bar{\rho} \eta$	$(6.0 \pm 0.4) \times 10^{-5}$		DESIG=200
Γ_{126}	$N(1535) \bar{\rho} +$ c.c. $\rightarrow \rho \bar{\rho} \eta$	$(4.5 \pm_{-0.6}^{+0.7}) \times 10^{-5}$		DESIG=264
Γ_{127}	$\rho \bar{\rho} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Γ_{128}	$\rho \bar{\rho} \rho^0$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Γ_{129}	$\rho \bar{\rho} \omega$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Γ_{130}	$\rho \bar{\rho} \eta'$	$(1.10 \pm 0.13) \times 10^{-5}$		DESIG=317
Γ_{131}	$\rho \bar{\rho} \phi$	$(6.1 \pm 0.6) \times 10^{-6}$		DESIG=80
Γ_{132}	$\phi X(1835) \rightarrow \rho \bar{\rho} \phi$	$< 1.82 \times 10^{-7}$	CL=90%	DESIG=318
Γ_{133}	$\rho \bar{n} \pi^-$ or c.c.	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Γ_{134}	$\rho \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Γ_{135}	$\Lambda \bar{\Lambda}$	$(3.81 \pm 0.13) \times 10^{-4}$	S=1.4	DESIG=28
Γ_{136}	$\Lambda \bar{\Lambda} \pi^0$	$(1.4 \pm 0.7) \times 10^{-6}$		DESIG=238
Γ_{137}	$\Lambda \bar{\Lambda} \eta$	$(2.43 \pm 0.32) \times 10^{-5}$		DESIG=239
Γ_{138}	$\Lambda(1670) \bar{\Lambda} \rightarrow \Lambda \bar{\Lambda} \eta$	$(1.3 \pm 0.7) \times 10^{-5}$		DESIG=336
Γ_{139}	$\Lambda \bar{\Lambda} \eta'$	$(7.3 \pm 1.0) \times 10^{-6}$		DESIG=346
Γ_{140}	$\Lambda \bar{\Lambda} \omega(782)$	$(3.3 \pm 0.4) \times 10^{-5}$		DESIG=340
Γ_{141}	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$		DESIG=213
Γ_{142}	$\Lambda \bar{\rho} K^+$	$(1.00 \pm 0.14) \times 10^{-4}$		DESIG=214
Γ_{143}	$\Lambda \bar{\rho} K^*(892)^+ +$ c.c.	$(6.3 \pm 0.7) \times 10^{-5}$		DESIG=321
Γ_{144}	$\Lambda \bar{\rho} K^+ \pi^+ \pi^-$	$(1.8 \pm 0.4) \times 10^{-4}$		DESIG=215
Γ_{145}	$\bar{\Lambda} n K_S^0 +$ c.c.	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Γ_{146}	$\Delta^{++} \bar{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		DESIG=70
Γ_{147}	$\Lambda \bar{\Sigma}^+ \pi^- +$ c.c.	$(1.40 \pm 0.13) \times 10^{-4}$		DESIG=280
Γ_{148}	$\Lambda \bar{\Sigma}^- \pi^+ +$ c.c.	$(1.54 \pm 0.14) \times 10^{-4}$		DESIG=281
Γ_{149}	$\Lambda \bar{\Sigma}^0 +$ c.c.	$(1.6 \pm 0.7) \times 10^{-6}$		DESIG=326
Γ_{150}	$\Lambda \bar{\Sigma}^0$			DESIG=307
Γ_{151}	$\Sigma^0 \bar{\rho} K^+ +$ c.c.	$(1.67 \pm 0.18) \times 10^{-5}$		DESIG=274
Γ_{152}	$\Sigma^+ \bar{\Sigma}^-$	$(2.43 \pm 0.10) \times 10^{-4}$	S=1.4	DESIG=223
Γ_{153}	$\Sigma^0 \bar{\Sigma}^0$	$(2.35 \pm 0.09) \times 10^{-4}$	S=1.1	DESIG=71
Γ_{154}	$\Sigma^- \bar{\Sigma}^+$	$(2.82 \pm 0.09) \times 10^{-4}$		DESIG=335
Γ_{155}	$\Sigma^+ \bar{\Sigma}^- \eta$	$(9.6 \pm 2.4) \times 10^{-6}$		DESIG=339
Γ_{156}	$\Sigma^+ \bar{\Sigma}^- \omega$	$(1.89 \pm 0.28) \times 10^{-5}$		DESIG=344
Γ_{157}	$\Sigma^+ \bar{\Sigma}^- \phi$	$(3.0 \pm 0.7) \times 10^{-6}$		DESIG=345
Γ_{158}	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(8.5 \pm 0.7) \times 10^{-5}$		DESIG=72
Γ_{159}	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(8.5 \pm 0.8) \times 10^{-5}$		DESIG=297
Γ_{160}	$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(6.9 \pm 0.7) \times 10^{-5}$		DESIG=299

Γ ₁₆₁	$\Xi^- \Xi^+$	$(2.87 \pm 0.11) \times 10^{-4}$	S=1.1	DESIG=29
Γ ₁₆₂	$\Xi^0 \Xi^0$	$(2.3 \pm 0.4) \times 10^{-4}$	S=4.2	DESIG=224
Γ ₁₆₃	$\Xi(1530)^0 \Xi(1530)^0$	$(6.8 \pm 0.4) \times 10^{-5}$		DESIG=73
Γ ₁₆₄	$\Lambda \Xi^+ K^- + \text{c.c.}$	$(3.67 \pm 0.22) \times 10^{-5}$		DESIG=293
Γ ₁₆₅	$\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ +$ c.c.	$(6.2 \pm 2.1) \times 10^{-6}$	S=1.5	DESIG=294
Γ ₁₆₆	$\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ +$ c.c.	$(1.48 \pm 0.29) \times 10^{-5}$	S=1.2	DESIG=295
Γ ₁₆₇	$\Xi(1530)^- \Xi(1530)^+$ c.c.	$(1.15 \pm 0.07) \times 10^{-4}$		DESIG=322
Γ ₁₆₈	$\Xi(1530)^- \Xi^+$	$(7.0 \pm 1.2) \times 10^{-6}$		DESIG=323
Γ ₁₆₉	$\Xi(1530)^0 \Xi^0$	$(5.3 \pm 0.5) \times 10^{-6}$		DESIG=331
Γ ₁₇₀	$\Sigma^0 \Xi^+ K^- + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		DESIG=296
Γ ₁₇₁	$\Omega^- K^+ \Xi^0 + \text{c.c.}$	$(2.8 \pm 0.4) \times 10^{-6}$		DESIG=355
Γ ₁₇₂	$\Omega^- \bar{\Omega}^+$	$(5.66 \pm 0.30) \times 10^{-5}$	S=1.3	DESIG=74
Γ ₁₇₃	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Γ ₁₇₄	$h_c(1P) \pi^0$	$(7.4 \pm 0.5) \times 10^{-4}$		DESIG=254
Γ ₁₇₅	$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	$< 1.7 \times 10^{-6}$	CL=90%	DESIG=310
Γ ₁₇₆	$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	[a] $< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Γ ₁₇₇	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	[a] $< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Γ ₁₇₈	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	[a] $< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Γ ₁₇₉	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	[a] $< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Γ ₁₈₀	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	[a] $< 6.0 \times 10^{-6}$	CL=90%	DESIG=199

Radiative decays

				NODE=M071;CLUMP=C
Γ ₁₈₁	$\gamma \chi_{c0}(1P)$	$(9.75 \pm 0.22) \%$	S=1.1	DESIG=56
Γ ₁₈₂	$\gamma \chi_{c1}(1P)$	$(9.75 \pm 0.27) \%$	S=1.1	DESIG=58
Γ ₁₈₃	$\gamma \chi_{c2}(1P)$	$(9.38 \pm 0.23) \%$	S=1.2	DESIG=59
Γ ₁₈₄	$\gamma \eta_c(1S)$	$(3.6 \pm 0.5) \times 10^{-3}$	S=1.3	DESIG=61
Γ ₁₈₅	$\gamma \eta_c(2S)$	$(5.4 \pm_{-2.9}^{+3.4}) \times 10^{-4}$		DESIG=63
Γ ₁₈₆	$\gamma \pi^0$			DESIG=52
Γ ₁₈₇	$\gamma 2(\pi^+ \pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		DESIG=241
Γ ₁₈₈	$\gamma 3(\pi^+ \pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=249
Γ ₁₈₉	$\gamma \eta'(958)$	$(1.24 \pm 0.04) \times 10^{-4}$		DESIG=54
Γ ₁₉₀	$\gamma f_2(1270)$	$(2.73 \pm_{-0.25}^{+0.29}) \times 10^{-4}$	S=1.8	DESIG=82
Γ ₁₉₁	$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(3.1 \pm 1.7) \times 10^{-5}$		DESIG=286
Γ ₁₉₂	$\gamma f_0(1500)$	$(9.3 \pm 1.9) \times 10^{-5}$		DESIG=287
Γ ₁₉₃	$\gamma f_2'(1525)$	$(3.3 \pm 0.8) \times 10^{-5}$		DESIG=288
Γ ₁₉₄	$\gamma f_0(1710)$	seen		DESIG=236;OUR EST;→ UNCHECKED ←
Γ ₁₉₅	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.5 \pm 0.6) \times 10^{-5}$		DESIG=83
Γ ₁₉₆	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(6.6 \pm 0.7) \times 10^{-5}$		DESIG=84
Γ ₁₉₇	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(4.8 \pm 1.0) \times 10^{-6}$		DESIG=289
Γ ₁₉₈	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(3.2 \pm 1.0) \times 10^{-6}$		DESIG=290
Γ ₁₉₉	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 5.8 \times 10^{-6}$	CL=90%	DESIG=291
Γ ₂₀₀	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 9.5 \times 10^{-6}$	CL=90%	DESIG=292
Γ ₂₀₁	$\gamma \eta$	$(9.2 \pm 1.8) \times 10^{-7}$		DESIG=53
Γ ₂₀₂	$\gamma \eta \pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		DESIG=230
Γ ₂₀₃	$\gamma \eta(1405)$	seen		DESIG=231;OUR EST;→ UNCHECKED ←
Γ ₂₀₄	$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	$< 9 \times 10^{-5}$	CL=90%	DESIG=62
Γ ₂₀₅	$\gamma \eta(1405) \rightarrow \gamma \eta \pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		DESIG=232
Γ ₂₀₆	$\gamma \eta(1405) \rightarrow \gamma f_0(980) \pi^0 \rightarrow$ $\gamma \pi^+ \pi^- \pi^0$	$< 5.0 \times 10^{-7}$	CL=90%	DESIG=308
Γ ₂₀₇	$\gamma \eta(1475)$	seen		DESIG=233;OUR EST;→ UNCHECKED ←
Γ ₂₀₈	$\gamma \eta(1475) \rightarrow \gamma K \bar{K} \pi$	$< 1.4 \times 10^{-4}$	CL=90%	DESIG=234
Γ ₂₀₉	$\gamma \eta(1475) \rightarrow \gamma \eta \pi^+ \pi^-$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=235
Γ ₂₁₀	$\gamma K^{*0} K^+ \pi^- + \text{c.c.}$	$(3.7 \pm 0.9) \times 10^{-4}$		DESIG=242
Γ ₂₁₁	$\gamma K^{*0} \bar{K}^{*0}$	$(2.4 \pm 0.7) \times 10^{-4}$		DESIG=243

Γ_{212}	$\gamma K_S^0 K^+ \pi^- + \text{c.c.}$	$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=244
Γ_{213}	$\gamma K^+ K^- \pi^+ \pi^-$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=245
Γ_{214}	$\gamma K^+ K^- 2(\pi^+ \pi^-)$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=248
Γ_{215}	$\gamma 2(K^+ K^-)$	$< 4 \times 10^{-5}$	CL=90%	DESIG=250
Γ_{216}	$\gamma p \bar{p}$	$(3.9 \pm 0.5) \times 10^{-5}$	S=2.0	DESIG=246
Γ_{217}	$\gamma f_2(1950) \rightarrow \gamma p \bar{p}$	$(1.20 \pm 0.22) \times 10^{-5}$		DESIG=257
Γ_{218}	$\gamma f_2(2150) \rightarrow \gamma p \bar{p}$	$(7.2 \pm 1.8) \times 10^{-6}$		DESIG=258
Γ_{219}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(4.6 \pm 1.8_{-4.0}) \times 10^{-6}$		DESIG=259
Γ_{220}	$\gamma X \rightarrow \gamma p \bar{p}$	$[b] < 2 \times 10^{-6}$	CL=90%	DESIG=260
Γ_{221}	$\gamma p \bar{p} \pi^+ \pi^-$	$(2.8 \pm 1.4) \times 10^{-5}$		DESIG=247
Γ_{222}	$\gamma \gamma$	$< 1.5 \times 10^{-4}$	CL=90%	DESIG=51
Γ_{223}	$\gamma \gamma J/\psi$	$(3.1 \pm 1.0_{-1.2}) \times 10^{-4}$		DESIG=266
Γ_{224}	$e^+ e^- \eta'$	$(1.90 \pm 0.26) \times 10^{-6}$		DESIG=311
Γ_{225}	$e^+ e^- \eta_c(1S)$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=338
Γ_{226}	$e^+ e^- \chi_{c0}(1P)$	$(1.05 \pm 0.25) \times 10^{-3}$		DESIG=300
Γ_{227}	$e^+ e^- \chi_{c1}(1P)$	$(8.5 \pm 0.7) \times 10^{-4}$		DESIG=301
Γ_{228}	$e^+ e^- \chi_{c2}(1P)$	$(6.8 \pm 0.8) \times 10^{-4}$		DESIG=302
Weak decays				
Γ_{229}	$D^0 e^+ e^- + \text{c.c.}$	$< 1.4 \times 10^{-7}$	CL=90%	NODE=M071;CLUMP=E DESIG=306
Γ_{230}	$\Lambda_c^+ \bar{\Sigma}^- + \text{c.c.}$	$< 1.4 \times 10^{-5}$	CL=90%	DESIG=337
Other decays				
Γ_{231}	invisible	$< 1.6 \%$	CL=90%	NODE=M071;CLUMP=D DESIG=275

[a] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54 \text{ GeV}/c^2$ mass and a width of less than $25 \text{ MeV}/c^2$.

LINKAGE=THT

[b] For a narrow resonance in the range $2.2 < M(X) < 2.8 \text{ GeV}$.

LINKAGE=NMR

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 88 branching ratios uses 255 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 393.1$ for 206 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_8	3									
x_9	0	0								
x_{12}	21	13	2							
x_{13}	22	5	1	28						
x_{14}	11	6	1	44	11					
x_{112}	0	0	0	3	2	1				
x_{181}	0	0	0	2	0	1	0			
x_{182}	1	0	0	2	0	1	0	0		
x_{183}	1	1	0	4	0	2	0	0	0	
Γ	-85	-4	-1	-29	-31	-15	-4	0	-1	-1
	x_7	x_8	x_9	x_{12}	x_{13}	x_{14}	x_{112}	x_{181}	x_{182}	x_{183}

FIT INFORMATION

A multiparticle fit to $\eta_c(2S)$ and $\psi(2S)$ with a combination of partial widths obtained from integrated cross sections and 4 branching ratios uses 7 measurements to determine 4 parameters. The overall fit has a $\chi^2 = 2.9$ for 3 degrees of freedom.

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and B^\pm with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

$\psi(2S)$ PARTIAL WIDTHS

$\Gamma(\text{hadrons})$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
258 ± 26	BAI	02B	BES2 e^+e^-
224 ± 56	LUTH	75	MRK1 e^+e^-

$\Gamma(e^+e^-)$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.33 ± 0.04 OUR FIT	Error includes scale factor of 1.1.		
2.29 ± 0.06 OUR AVERAGE			
$2.23 \pm 0.10 \pm 0.02$	¹ ABLIKIM	15V	BES3 $4.0-4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$2.338 \pm 0.037 \pm 0.096$	ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{hadrons}$
$2.330 \pm 0.036 \pm 0.110$	ABLIKIM	06L	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.44 ± 0.21	² BAI	02B	BES2 e^+e^-
2.14 ± 0.21	ALEXANDER	89	RVUE See Υ mini-review
$2.279 \pm 0.015 \pm 0.042$	³ ANASHIN	18	KEDR e^+e^-
$2.282 \pm 0.015 \pm 0.042$	⁴ ANASHIN	18	KEDR e^+e^-
2.0 ± 0.3	BRANDELIK	79C	DASP e^+e^-
2.1 ± 0.3	⁵ LUTH	75	MRK1 e^+e^-

- ¹ ABLIKIM 15V reports $2.213 \pm 0.018 \pm 0.099$ keV from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^-)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.95 \pm 0.45) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channel, assuming $\Gamma_e = \Gamma_\mu = \Gamma_\tau/0.38847$.
- ³ Combining $\Gamma_{e^+e^-} \cdot B(\mu^+\mu^-)$ from ANASHIN 18 with $\Gamma_{e^+e^-} \cdot B(\text{hadrons})$ from ANASHIN 12 and assuming lepton universality.
- ⁴ From the sum of $\Gamma_{e^+e^-} \cdot B(\text{hadrons})$ from ANASHIN 12, $\Gamma_{e^+e^-} \cdot B(e^+e^-)$ and $\Gamma_{e^+e^-} \cdot B(\mu^+\mu^-)$ from ANASHIN 18, and $\Gamma_{e^+e^-} \cdot B(\tau^+\tau^-)$ from ANASHIN 07.
- ⁵ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

$\Gamma(\gamma\gamma)$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRANDELIK	79C	DASP e^+e^-

$\psi(2S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel(i) in the e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(i)$ or the branching ratio $\Gamma(i)/\text{total}$.

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$2.233 \pm 0.015 \pm 0.042$	¹ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
2.2 ± 0.4	ABRAMS	75	MRK1 e^+e^-

- ¹ ANASHIN 12 reports the value $2.233 \pm 0.015 \pm 0.037 \pm 0.020$ keV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

NODE=M071225

NODE=M071W3
NODE=M071W3NODE=M071W1
NODE=M071W1

OCCUR=2

NODE=M071W1;LINKAGE=A

NODE=M071W;LINKAGE=BB

NODE=M071W1;LINKAGE=B

NODE=M071W1;LINKAGE=C

NODE=M071W1;LINKAGE=F

NODE=M071W51
NODE=M071W51

NODE=M071230

NODE=M071230

NODE=M071G3
NODE=M071G3

NODE=M071G3;LINKAGE=AN

$\Gamma(K_S^0 \text{ anything}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_6 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.3738 ± 0.0067 ± 0.0200	ABLIKIM	21S	BES3 $e^+ e^- \rightarrow K_S^0 \text{ anything}$

NODE=M071P30
 NODE=M071P30

 $\Gamma(e^+ e^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
21.2 ± 0.7 ± 1.2	¹ ANASHIN	18	KEDR $e^+ e^-$

NODE=M071P14
 NODE=M071P14

¹ From the average of nine scans of the $\psi(2S)$.

NODE=M071P14;LINKAGE=A

 $\Gamma(\mu^+ \mu^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
19.3 ± 0.3 ± 0.5	¹ ANASHIN	18	KEDR $\psi(2S) \rightarrow \mu^+ \mu^-$

NODE=M071P13
 NODE=M071P13

¹ From the average of nine scans of the $\psi(2S)$.

NODE=M071P13;LINKAGE=A

 $\Gamma(\tau^+ \tau^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_7 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

9.0 ± 2.6	79	¹ ANASHIN	07	KEDR $e^+ e^- \rightarrow \psi(2S) \rightarrow \tau^+ \tau^-$
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¹ Using $\psi(2S)$ total width of 337 ± 13 keV. Systematic errors not evaluated.

NODE=M071G9
 NODE=M071G9

NODE=M071G9;LINKAGE=AN

 $\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{12} \Gamma_7 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.808 ± 0.014 OUR FIT Error includes scale factor of 1.1.

0.836 ± 0.025 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

0.78 ± 0.12 ± 0.07		¹ LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
--------------------	--	-------------------	----	---

0.837 ± 0.028 ± 0.005		² LEES	12E	BABR $10.6 e^+ e^- \rightarrow 2\pi^+ 2\pi^- \gamma$
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0.852 ± 0.010 ± 0.026	19.5k	ADAM	06	CLEO $3.773 e^+ e^- \rightarrow \gamma \psi(2S)$
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0.68 ± 0.09		³ BAI	98E	BES $e^+ e^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.93 ± 0.08 ± 0.03	256	⁴ AUBERT	07AU	BABR $10.6 e^+ e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$
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0.755 ± 0.048 ± 0.004	544	⁵ AUBERT	05D	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- \mu^+ \mu^- \gamma$
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NODE=M071G1
 NODE=M071G1

NODE=M071G1;LINKAGE=B

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow K_S^0 K^\pm \pi^\mp)] = (4.14 \pm 0.55 \pm 0.29) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = (5.3 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² LEES 12E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+ \mu^-)] = (49.9 \pm 1.3 \pm 1.0) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G1;LINKAGE=LE

³ The value of $\Gamma(e^+ e^-)$ quoted in BAI 98E is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6) \times 10^{-2}$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1203 \pm 0.0038$. Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

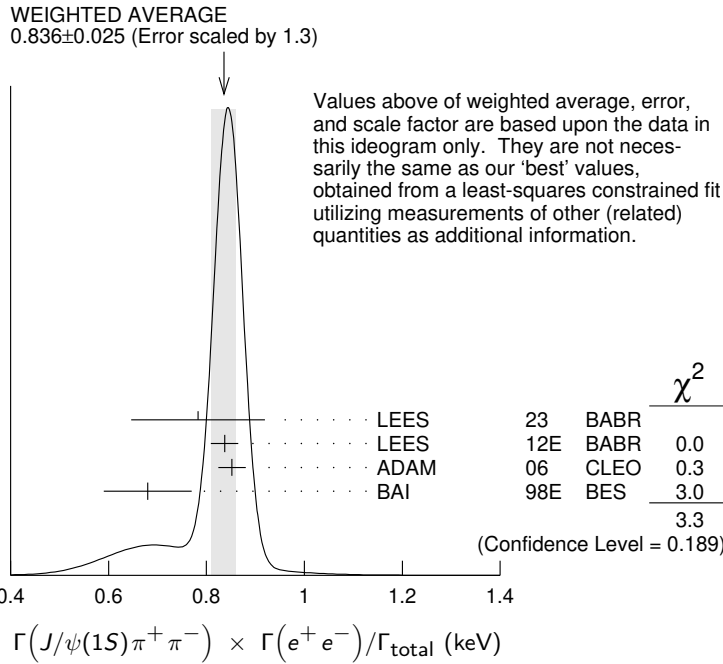
NODE=M071G1;LINKAGE=A

⁴ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \pi^+ \pi^- \pi^0)] = 0.0186 \pm 0.0012 \pm 0.0011$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+ \pi^- \pi^0) = (2.00 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G1;LINKAGE=UB

⁵ AUBERT 05D reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+ \mu^-)] = 0.0450 \pm 0.0018 \pm 0.0022$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by LEES 12E.

NODE=M071G1;LINKAGE=AU



$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{13}\Gamma_7/\Gamma$

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

0.425±0.012 OUR FIT Error includes scale factor of 1.4.

0.413±0.019 OUR AVERAGE

0.45 ±0.13 ±0.02	1	LEES	23	BABR	$e^+e^- \rightarrow \gamma_{ISR} \text{hadrons}$
0.45 ±0.12 ±0.04	2	LEES	23	BABR	$e^+e^- \rightarrow \gamma_{ISR} \text{hadrons}$
0.411±0.008±0.018	3.6k	ADAM	06	CLEO	3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G6
NODE=M071G6

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.51 ±0.09 ±0.02 142 3 LEES 18E BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^0\pi^0\gamma$

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{total}] \times [B(J/\psi(1S) \rightarrow K^+K^-\pi^0)] = (1.31 \pm 0.35 \pm 0.13) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K^+K^-\pi^0) = (2.88 \pm 0.12) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G6;LINKAGE=C

² LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{total}] \times [B(J/\psi(1S) \rightarrow K_S^0 K^\pm\pi^\mp)] = (2.36 \pm 0.59 \pm 0.24) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K_S^0 K^\pm\pi^\mp) = (5.3 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G6;LINKAGE=D

³ LEES 18E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{total}] \times [B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)] = 0.0101 \pm 0.0015 \pm 0.0011$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.00 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G6;LINKAGE=A

$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{14}\Gamma_7/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

78.6± 1.8 OUR FIT Error includes scale factor of 1.1.

87 ± 9 OUR AVERAGE

83 ±25 ±5	14	1 AUBERT	07AU	BABR	10.6 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\pi^0\gamma$
88 ± 6 ±7	291 ± 24	ADAM	06	CLEO	3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G7
NODE=M071G7

¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07$ eV.

NODE=M071G7;LINKAGE=UB

$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{15}\Gamma_7/\Gamma$

VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT

<8 90 <37 ADAM 06 CLEO 3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G8
NODE=M071G8

$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{total}$ $\Gamma_{22}\Gamma_7/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

29.7±2.2±1.8 410 AUBERT 07AU BABR 10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M071G01
NODE=M071G01

$$\Gamma(\pi^+\pi^-\pi^0\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±1.8±1.2	177	LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ 3π ⁰ γ

NODE=M071P16
NODE=M071P16

$$\Gamma(\pi^+\pi^-4\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±2.3±0.5	18	LEES	21C	BABR e ⁺ e ⁻ → γ _{ISR} (π ⁺ π ⁻ 4π ⁰)

NODE=M071P36
NODE=M071P36

$$\Gamma(\rho^\pm\pi^\mp\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.2	90	LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ 3π ⁰ γ

NODE=M071P18
NODE=M071P18

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.2±3.3±1.3	43	AUBERT	06D	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻ π ⁰)γ

NODE=M071G4
NODE=M071G4

$$\Gamma(2(\pi^+\pi^-)3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{30}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33±5±5	14k	LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ

NODE=M071P31
NODE=M071P31

$$\Gamma(\eta 2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{33}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±1.41±0.01		16	¹ AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)ηγ

NODE=M071G03
NODE=M071G03

••• We do not use the following data for averages, fits, limits, etc. •••

<7	90	14k	² LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ
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¹AUBERT 07AU reports [$\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.13 \pm 0.55 \pm 0.08$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G03;LINKAGE=UB

²LEES 21 reports [$\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] < 2.3$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = 32.56 \times 10^{-2}$.

NODE=M071G03;LINKAGE=A

$$\Gamma(\eta\pi^+\pi^-\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{34}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.85	90	LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ π ⁰ ηγ

NODE=M071P15
NODE=M071P15

$$\Gamma(\eta\pi^+\pi^-3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{35}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ LEES	21C	BABR e ⁺ e ⁻ → γ _{ISR} (π ⁺ π ⁻ 3π ⁰ γγ)

NODE=M071P40
NODE=M071P40

¹LEES 21C reports [$\Gamma(\psi(2S) \rightarrow \eta\pi^+\pi^-3\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 1.9$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M071P40;LINKAGE=A

$$\Gamma(\eta 2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<5	90	14k	¹ LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ

NODE=M071P33
NODE=M071P33

¹LEES 21 reports [$\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-\pi^0)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 1.9$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M071P33;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.01±0.84±0.02	37	¹ AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → ωπ ⁺ π ⁻ γ

NODE=M071G02
NODE=M071G02

¹AUBERT 07AU reports [$\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.69 \pm 0.73 \pm 0.16$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G02;LINKAGE=UB

$$\Gamma(\omega\pi^+\pi^-2\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.2±5.6±0.1	14k	¹ LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ

NODE=M071P32
NODE=M071P32

¹ LEES 21 reports [$\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-2\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = 18 \pm 4 \pm 3$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P32;LINKAGE=A

$$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.58±0.82±0.02	33	¹ LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ 3π ⁰ γ

NODE=M071P17
NODE=M071P17

¹ LEES 18E reports [$\Gamma(\psi(2S) \rightarrow \omega\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = 2.3 \pm 0.7 \pm 0.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P17;LINKAGE=A

$$\Gamma(\omega 3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ LEES	21C	BABR e ⁺ e ⁻ → γ _{ISR} (π ⁺ π ⁻ 4π ⁰)

NODE=M071P39
NODE=M071P39

¹ LEES 21C reports [$\Gamma(\psi(2S) \rightarrow \omega 3\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) < 1.6$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = 89.2 \times 10^{-2}$.

NODE=M071P39;LINKAGE=A

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.54±0.18 OUR AVERAGE		[0.55 ± 0.19 eV OUR 2024 AVERAGE]		

NODE=M071G10
NODE=M071G10

NEW

0.54±0.18±0.01 19 ¹ LEES 12F BABR 10.6 e⁺e⁻ → K⁺K⁻π⁺π⁻γ

••• We do not use the following data for averages, fits, limits, etc. •••

0.56±0.22±0.01 10 ² AUBERT,BE 06D BABR 10.6 e⁺e⁻ → K⁺K⁻π⁺π⁻γ

¹ LEES 12F reports [$\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\phi(1020) \rightarrow K^+K^-) = 0.27 \pm 0.09 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=A

² Superseded by LEES 12F. AUBERT,BE 06D reports [$\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\phi(1020) \rightarrow K^+K^-) = 0.28 \pm 0.11 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=AU

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{52}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.34 ±0.13 OUR AVERAGE		[0.35 ± 0.13 eV OUR 2024 AVERAGE]		

NODE=M071G13
NODE=M071G13

NEW

0.341±0.127±0.004 12 ¹ LEES 12F BABR 10.6 e⁺e⁻ → π⁺π⁻K⁺K⁻γ

••• We do not use the following data for averages, fits, limits, etc. •••

0.341±0.165±0.004 6±3 ² AUBERT 07AK BABR 10.6 e⁺e⁻ → π⁺π⁻K⁺K⁻γ

¹ LEES 12F reports [$\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\phi(1020) \rightarrow K^+K^-) = 0.17 \pm 0.06 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=A

² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [$B(\phi(1020) \rightarrow K^+K^-) = 0.17 \pm 0.08 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.9 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=AU

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{60}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.147±0.035±0.005	66	¹ LEES	15J	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ
0.197±0.035±0.005	66	² LEES	15J	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ
0.35 ±0.14 ±0.03	11	³ LEES	13Q	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ

NODE=M071G06
NODE=M071G06

OCCUR=2

••• We do not use the following data for averages, fits, limits, etc. •••

0.147±0.035±0.005 66 ¹ LEES 15J BABR e⁺e⁻ → K⁺K⁻γ

0.197±0.035±0.005 66 ² LEES 15J BABR e⁺e⁻ → K⁺K⁻γ

0.35 ±0.14 ±0.03 11 ³ LEES 13Q BABR e⁺e⁻ → K⁺K⁻γ

¹ sinφ > 0.

² sinφ < 0.

³ Interference with non-resonant K⁺K⁻ production not taken into account.

NODE=M071G06;LINKAGE=A
NODE=M071G06;LINKAGE=B
NODE=M071G06;LINKAGE=BA

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{61}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.92±0.30±0.06	133	LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.56±0.42±0.16	85	¹ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ
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¹ Superseded by LEES 12F.

NODE=M071G12
NODE=M071G12

NODE=M071G12;LINKAGE=A

$$\Gamma(K_S^0 K_L^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{65}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<0.7	90	8	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ γ
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NODE=M071G15
NODE=M071G15

$$\Gamma(K^+K^-\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{66}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.60±0.31±0.03	17	LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ
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NODE=M071G08
NODE=M071G08

$$\Gamma(K^+K^-\pi^0\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{67}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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1.54±0.63±0.15	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P47
NODE=M071P47

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{68}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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4.0±1.4±0.4	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P48
NODE=M071P48

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{69}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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5.1±0.7±0.4	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P49
NODE=M071P49

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{70}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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4.4±1.3±0.3	32	AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰ γ
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NODE=M071G04
NODE=M071G04

$$\Gamma(K_S^0 K_L^0 \pi^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{77}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.92±1.27±0.15	14	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ π ⁰ γ
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NODE=M071G14
NODE=M071G14

$$\Gamma(K_S^0 K^*(892)^0 \pi^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{78}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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0.71±0.29±0.07	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P54
NODE=M071P54

$$\Gamma(K_S^0 K^\pm \rho(770)^\mp \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{79}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<1.6	90	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P58
NODE=M071P58

$$\Gamma(K_S^0 K^\pm \pi^\mp \rho(770)^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{80}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<1.6	90	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P59
NODE=M071P59

$$\Gamma(K^*(892)^+ K^*(892)^- \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{82}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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8.46±4.05±0.90	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P56
NODE=M071P56

$$\Gamma(K^\mp K^*(892)^\pm \pi^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{81}\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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1.62±0.66±0.15	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons
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NODE=M071P55
NODE=M071P55

$$\Gamma(K_S^0 K_L^0 \eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{83}\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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3.14±1.08±0.16	16	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ ηγ
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NODE=M071G16
NODE=M071G16

$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{86}\Gamma_7/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.05±1.80±0.01	7	¹ AUBERT 07AU BABR	10.6	$e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

NODE=M071G05
 NODE=M071G05

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.2 \pm 0.7 \pm 0.1$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G05;LINKAGE=UB

 $\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{87}\Gamma_7/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±2.1±0.3	26	AUBERT 06D BABR	10.6	$e^+e^- \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

NODE=M071G5
 NODE=M071G5

 $\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{90}\Gamma_7/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.10±0.02	13	LEES 12F BABR	10.6	$e^+e^- \rightarrow K^+K^-K^+K^-\gamma$

NODE=M071G07
 NODE=M071G07

 $\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{112}\Gamma_7/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.686±0.024 OUR FIT				Error includes scale factor of 1.2.

NODE=M071G2
 NODE=M071G2

0.63 ±0.05 OUR AVERAGE Error includes scale factor of 1.2.

0.67 ±0.12 ±0.02	43	¹ LEES 130 BABR		$e^+e^- \rightarrow p\bar{p}\gamma$
0.74 ±0.07 ±0.04	142	² LEES 13Y BABR		$e^+e^- \rightarrow p\bar{p}\gamma$
0.579±0.038±0.036	2.7k	ANDREOTTI 07 E835		$p\bar{p} \rightarrow e^+e^-, J/\psi X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.70 ±0.17 ±0.03	22	³ AUBERT 06B BABR		$e^+e^- \rightarrow p\bar{p}\gamma$
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¹ ISR photon reconstructed in the detector

² ISR photon undetected

³ Superseded by LEES 130

NODE=M071G2;LINKAGE=C
 NODE=M071G2;LINKAGE=B
 NODE=M071G2;LINKAGE=A

 $\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{135}\Gamma_7/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT 07BD BABR	10.6	$e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M071G11
 NODE=M071G11

 $\psi(2S)$ BRANCHING RATIOS

NODE=M071235

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.9785±0.0013 OUR AVERAGE			
0.9779±0.0015	¹ BAI 02B BES2		e^+e^-
0.981 ±0.003	¹ LUTH 75 MRK1		e^+e^-

NODE=M071R3
 NODE=M071R3

¹ Includes cascade decay into $J/\psi(1S)$.

NODE=M071R;LINKAGE=P

 $\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0179±0.0004	¹ LIAO 23 RVUE		e^+e^-
0.0166±0.0010	^{2,3} SETH 04 RVUE		e^+e^-
0.0199±0.0019	² BAI 02B BES2		e^+e^-
0.029 ±0.004	² LUTH 75 MRK1		e^+e^-

NODE=M071R5
 NODE=M071R5

¹ Using $B(\psi(2S) \rightarrow \ell^+\ell^-) = (0.794 \pm 0.017)\%$ and $R = 2.26 \pm 0.01$ determined by a fit to data from Mark-I, DM2, BESII, KEDR, and BESIII.

² Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.

³ Using $B(\psi(2S) \rightarrow \ell^+\ell^-) = (0.73 \pm 0.04)\%$ from RPP-2002 and $R = 2.28 \pm 0.04$ determined by a fit to data from BAI 00 and BAI 02c. Superseded by LIAO 23.

NODE=M071R5;LINKAGE=A

NODE=M071R;LINKAGE=Z
 NODE=M071R5;LINKAGE=SE

 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
10.58±1.62	2.9 M	¹ LIBBY 09 CLEO		$\psi(2S) \rightarrow \text{hadrons}$

NODE=M071S43
 NODE=M071S43

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09, $B(\psi(2S) \rightarrow X J/\psi)$ relative and absolute branching fractions from MENDEZ 08, $B(\psi(2S) \rightarrow \gamma \eta_c)$ from MITCHELL 09, and $B(\psi(2S) \rightarrow \text{virtual } \gamma \rightarrow \text{hadrons})$, $B(\psi(2S) \rightarrow \gamma \chi_{cJ})$, and $B(\psi(2S) \rightarrow \ell^+\ell^-)$ from PDG 08. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(\gamma g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.

NODE=M071S43;LINKAGE=LI

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.025±0.288	200 k	¹ LIBBY	09	CLEO $\psi(2S) \rightarrow \gamma + \text{hadrons}$

NODE=M071S44
NODE=M071S44

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(g g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.

NODE=M071S44;LINKAGE=LI

 $\Gamma(\gamma g g)/\Gamma(g g g)$ Γ_4/Γ_3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.7±2.6±1.6	2.9 M	LIBBY	09	CLEO $\psi(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M071S45
NODE=M071S45

 $\Gamma(\text{light hadrons})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.154±0.015	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow \psi(2S)$

NODE=M071S27
NODE=M071S27

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.169±0.026 ² ADAM 05A CLEO $e^+e^- \rightarrow \psi(2S)$

¹ Uses $B(\psi(2S) \rightarrow J/\psi X)$ from MENDEZ 08 and other branching fractions from PDG 07.

NODE=M071S27;LINKAGE=ME

² Uses $B(J/\psi X)$ from ADAM 05A, $B(\chi_{cJ}\gamma)$, $B(\eta_c\gamma)$ from ATHAR 04 and $B(\ell^+\ell^-)$ from PDG 04. Superseded by MENDEZ 08.

NODE=M071S27;LINKAGE=AD

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
79.4± 2.2 OUR FIT	Error includes scale factor of 1.3.		

NODE=M071R1
NODE=M071R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

88 ±13 ¹ FELDMAN 77 RVUE e^+e^-

¹ From an overall fit assuming equal partial widths for e^+e^- and $\mu^+\mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	DOCUMENT ID
80±6 OUR FIT	

NODE=M071R2
NODE=M071R2

 $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ Γ_8/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
1.00±0.08 OUR FIT			

NODE=M071R4
NODE=M071R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.89±0.16 BOYARSKI 75C MRK1 e^+e^-

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
31 ±4 OUR FIT			

NODE=M071R75
NODE=M071R75

30.8±2.1±3.8 ¹ ABLIKIM 06W BES $e^+e^- \rightarrow \psi(2S)$

¹ Computed using PDG 02 value of $B(\psi(2S) \rightarrow \text{hadrons}) = 0.9810 \pm 0.0030$ to estimate the total number of $\psi(2S)$ events.

NODE=M071R75;LINKAGE=AB

————— DECAYS INTO $J/\psi(1S)$ AND ANYTHING —————

NODE=M071305

 $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$
 $\Gamma_{10}/\Gamma = (\Gamma_{12} + \Gamma_{13} + \Gamma_{14} + 0.343\Gamma_{182} + 0.195\Gamma_{183})/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.615 ±0.007 OUR FIT				Error includes scale factor of 1.3.

NODE=M071R10
NODE=M071R10

0.55 ±0.07 OUR AVERAGE

0.51 ±0.12 BRANDELIK 79C DASP $e^+e^- \rightarrow \mu^+\mu^-X$

0.57 ±0.08 ABRAMS 75B MRK1 $e^+e^- \rightarrow \mu^+\mu^-X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.644 ±0.006 ±0.016 ¹ ABLIKIM 21Z BES3 $e^+e^- \rightarrow \ell^+\ell^-X$

0.6254±0.0016±0.0155 1.1M ² MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-X$

0.5950±0.0015±0.0190 151k ADAM 05A CLEO Repl. by MENDEZ 08

¹ From a fit to the $e^+e^- \rightarrow J/\psi X$ cross section between 3.645 and 3.891 GeV, with $\Gamma(ee)$ and Γ fixed to the PDG 20 values of the cross particle fit which are correlated to "OUR FIT" value for $B(\psi(2S) \rightarrow J/\psi X)$.

NODE=M071R10;LINKAGE=A

² Not independent from other measurements of MENDEZ 08.

NODE=M071R10;LINKAGE=ME

$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$

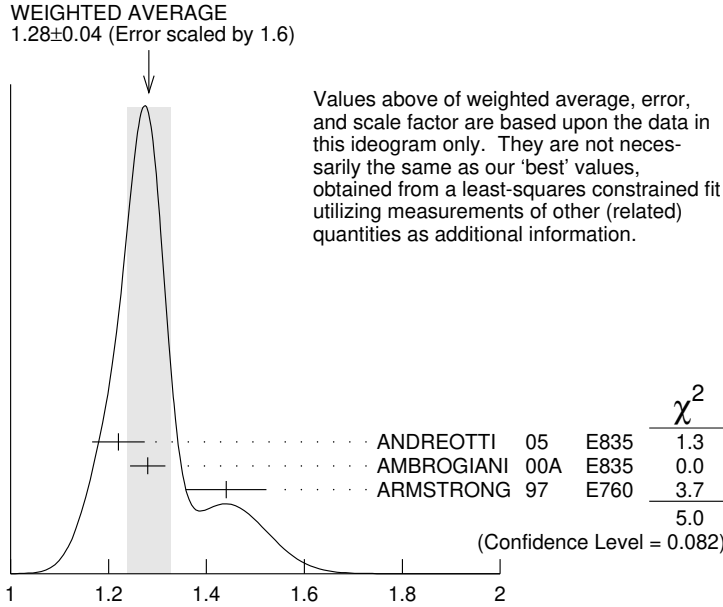
Γ_7/Γ_{10}

NODE=M071R72
NODE=M071R72

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.291 ± 0.035 OUR FIT				Error includes scale factor of 1.3.
1.28 ± 0.04 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
1.22 ± 0.02 ± 0.05	5097 ± 73	¹ ANDREOTTI 05	E835	$p\bar{p} \rightarrow \psi(2S) \rightarrow e^+e^-$
1.28 ± 0.03 ± 0.02		¹ AMBROGIANI 00A	E835	$p\bar{p} \rightarrow \psi(2S)$
1.44 ± 0.08 ± 0.02		¹ ARMSTRONG 97	E760	$p\bar{p} \rightarrow \psi(2S)$

¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R;LINKAGE=7A



$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$ **Γ_7/Γ_{10}**
(units 10^{-2})

$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$

Γ_8/Γ_{10}

NODE=M071R74
NODE=M071R74

VALUE	DOCUMENT ID	TECN	COMMENT
0.0130 ± 0.0010 OUR FIT			
0.014 ± 0.003	HILGER 75	SPEC	e^+e^-

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$

Γ_{11}/Γ

NODE=M071R18
NODE=M071R18

VALUE	DOCUMENT ID
0.254 ± 0.005 OUR FIT	Error includes scale factor of 1.6.

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

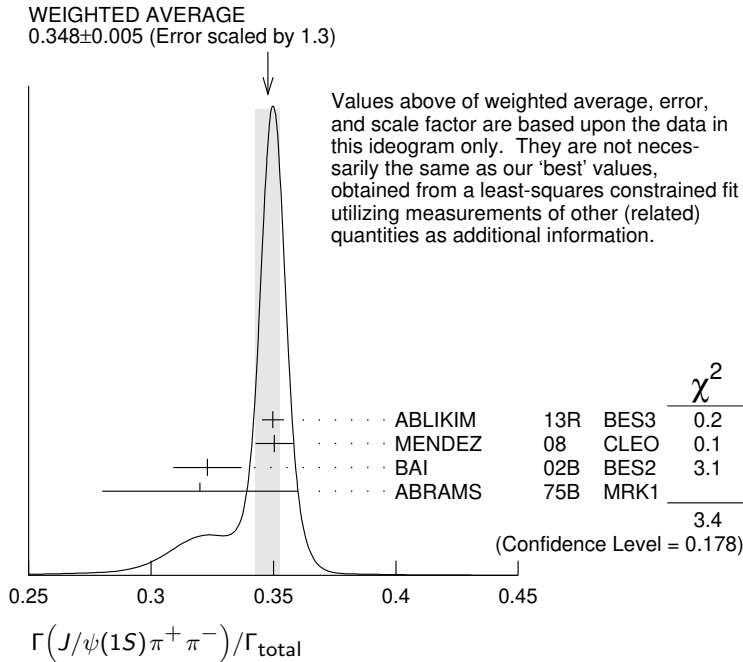
Γ_{12}/Γ

NODE=M071R12
NODE=M071R12

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3469 ± 0.0034 OUR FIT				Error includes scale factor of 1.1.
0.348 ± 0.005 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.3498 ± 0.0002 ± 0.0045	20M	ABLIKIM 13R	BES3	$\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
0.3504 ± 0.0007 ± 0.0077	565k	MENDEZ 08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$
0.323 ± 0.014		BAI 02B	BES2	e^+e^-
0.32 ± 0.04		ABRAMS 75B	MRK1	$e^+e^- \rightarrow J/\psi\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.3354 ± 0.0014 ± 0.0110	60k	¹ ADAM 05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

NODE=M071R;LINKAGE=AD



$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_7/Γ_{12}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0006 OUR FIT			Error includes scale factor of 1.3.
0.0252±0.0028±0.0011	¹ AUBERT	02B BABR	e^+e^-

¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R73
NODE=M071R73

NODE=M071R73;LINKAGE=7A

$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_8/Γ_{12}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0230±0.0017 OUR FIT			
0.0228±0.0018 OUR AVERAGE			
0.0230±0.0020±0.0012	¹ AAIJ	16Y LHCB	$\Lambda_b^0 \rightarrow \psi(2S)X$
0.0216±0.0026±0.0014	² AUBERT	02B BABR	e^+e^-
0.0327±0.0077±0.0072	² GRIBUSHIN	96 FMPS	$515 \pi^- Be \rightarrow 2\mu X$

¹ Using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$.
² Using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.88 \pm 0.10) \times 10^{-2}$.

NODE=M071R63
NODE=M071R63

NODE=M071R63;LINKAGE=A
NODE=M071R;LINKAGE=Q2

$\Gamma(\tau^+\tau^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_9/Γ_{12}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8 ±1.1 OUR FIT			
8.73±1.39±1.57	BAI	02 BES	e^+e^-

NODE=M071R76
NODE=M071R76

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$

Γ_{12}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.564 ±0.004 OUR FIT				Error includes scale factor of 1.7.
0.554 ±0.008 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.5604±0.0009±0.0062	565k	MENDEZ 08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$
0.525 ±0.009 ±0.022	4k	ANDREOTTI 05	E835	$\psi(2S) \rightarrow J/\psi X$
0.536 ±0.007 ±0.016	20k	^{1,2} ABLIKIM 04B	BES	$\psi(2S) \rightarrow J/\psi X$
0.496 ±0.037		ARMSTRONG 97	E760	$\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

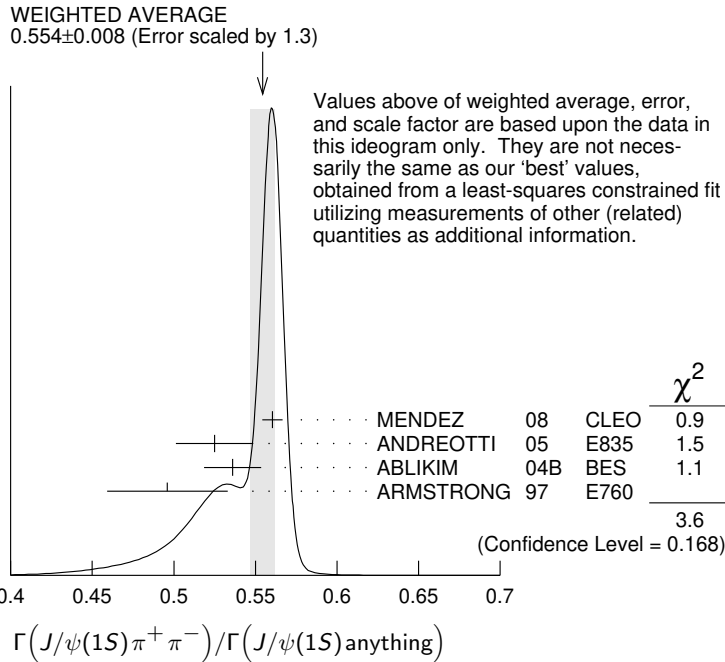
0.5637±0.0027±0.0046	60k	ADAM 05A	CLEO	Repl. by MENDEZ 08
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NODE=M071R70
NODE=M071R70

¹ From a fit to the J/ψ recoil mass spectra.

² ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)$.

NODE=M071R;LINKAGE=AB
NODE=M071R;LINKAGE=AL



$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{11}/\Gamma_{12} = (0.9761\Gamma_{13} + 0.719\Gamma_{14} + 0.343\Gamma_{182} + 0.195\Gamma_{183})/\Gamma_{12}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.732 ± 0.013 OUR FIT	Error includes scale factor of 1.7.		
0.73 ± 0.09	TANENBAUM 76	MRK1	e^+e^-

NODE=M071R11
NODE=M071R11

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{13}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.297 ± 0.005 OUR FIT	Error includes scale factor of 1.7.			
0.320 ± 0.012 OUR AVERAGE				
0.300 ± 0.008 ± 0.022	1655 ± 44	ANDREOTTI 05 E835		$\psi(2S) \rightarrow J/\psi X$
0.328 ± 0.013 ± 0.008		AMBROGIANI 00A E835		$p\bar{p} \rightarrow \psi(2S)$
0.323 ± 0.033		ARMSTRONG 97 E760		$\bar{p}p \rightarrow \psi(2S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.2829 ± 0.0012 ± 0.0056	61k	MENDEZ 08 CLEO		$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.2776 ± 0.0025 ± 0.0043	13.4k	ADAM 05A CLEO		Repl. by MENDEZ 08

NODE=M071R69
NODE=M071R69

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{13}/Γ_{12}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.526 ± 0.013 OUR FIT	Error includes scale factor of 1.7.			
0.513 ± 0.022 OUR AVERAGE	Error includes scale factor of 2.2.			
0.5047 ± 0.0022 ± 0.0102	61k	MENDEZ 08 CLEO		$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.570 ± 0.009 ± 0.026	14k	¹ ABLIKIM 04B BES		$\psi(2S) \rightarrow J/\psi X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.4924 ± 0.0047 ± 0.0086	73k	^{2,3} ADAM 05A CLEO		Repl. by MENDEZ 08
0.571 ± 0.018 ± 0.044		⁴ ANDREOTTI 05 E835		$\psi(2S) \rightarrow J/\psi X$
0.53 ± 0.06		TANENBAUM 76 MRK1		e^+e^-
0.64 ± 0.15		⁵ HILGER 75 SPEC		e^+e^-

NODE=M071R14
NODE=M071R14

¹ From a fit to the J/ψ recoil mass spectra.

² Not independent from other values reported by ADAM 05A.

³ Using 13,217 $J/\psi\pi^0\pi^0$ and 60,010 $J/\psi\pi^+\pi^-$ events.

⁴ Not independent from other values reported by ANDREOTTI 05.

⁵ Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

NODE=M071R14;LINKAGE=AB
 NODE=M071R14;LINKAGE=AD
 NODE=M071R14;LINKAGE=AM
 NODE=M071R;LINKAGE=AN
 NODE=M071R;LINKAGE=I

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
33.7 ± 0.6 OUR FIT	Error includes scale factor of 1.2.			
32.9 ± 1.7 OUR AVERAGE	Error includes scale factor of 2.1. See the ideogram below.			
33.75 ± 0.17 ± 0.86	68.2k	ABLIKIM 12M BES3		$e^+e^- \rightarrow \ell^+\ell^-2\gamma$
29.8 ± 0.9 ± 2.3	5.7k	BAI 04I BES2		$\psi(2S) \rightarrow J/\psi\gamma\gamma$
25.5 ± 2.9	386	¹ OREGLIA 80 CBAL		$e^+e^- \rightarrow J/\psi 2\gamma$
45 ± 12	17	² BRANDELIK 79B DASP		$e^+e^- \rightarrow J/\psi 2\gamma$
42 ± 6	164	² BARTEL 78B CNTR		e^+e^-

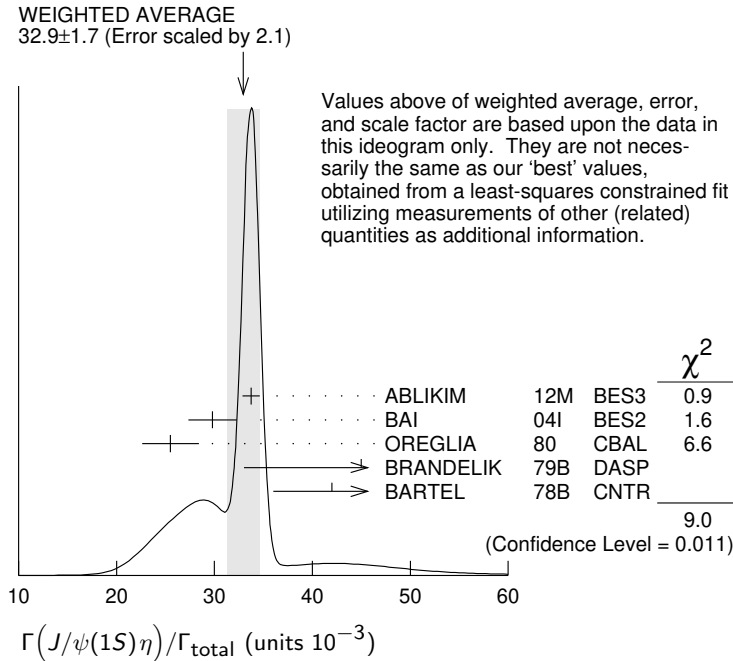
NODE=M071R15
NODE=M071R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

34.3 ± 0.4 ± 0.9	18.4k	³ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \eta$
32.5 ± 0.6 ± 1.1	2.8k	⁴ ADAM	05A	CLEO	Repl. by MENDEZ 08
43 ± 8	44	TANENBAUM	76	MRK1	$e^+ e^-$

- ¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.
- ² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.
- ³ Not independent from other measurements of MENDEZ 08.
- ⁴ Not independent from other values reported by ADAM 05A.

NODE=M071R;LINKAGE=3Q
 NODE=M071R;LINKAGE=2Q
 NODE=M071R15;LINKAGE=ME
 NODE=M071R15;LINKAGE=AD



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{14}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0549±0.0009 OUR FIT				Error includes scale factor of 1.2.
0.058 ±0.007 OUR AVERAGE				Error includes scale factor of 1.4. See the ideogram below.
0.050 ±0.006 ±0.003	298 ± 20	ANDREOTTI 05	E835	$\psi(2S) \rightarrow J/\psi X$
0.072 ±0.009		AMBROGIANI 00A	E835	$\rho\bar{\rho} \rightarrow \psi(2S)$
0.061 ±0.015		ARMSTRONG 97	E760	$\bar{p}p \rightarrow \psi(2S)$

NODE=M071R68
 NODE=M071R68

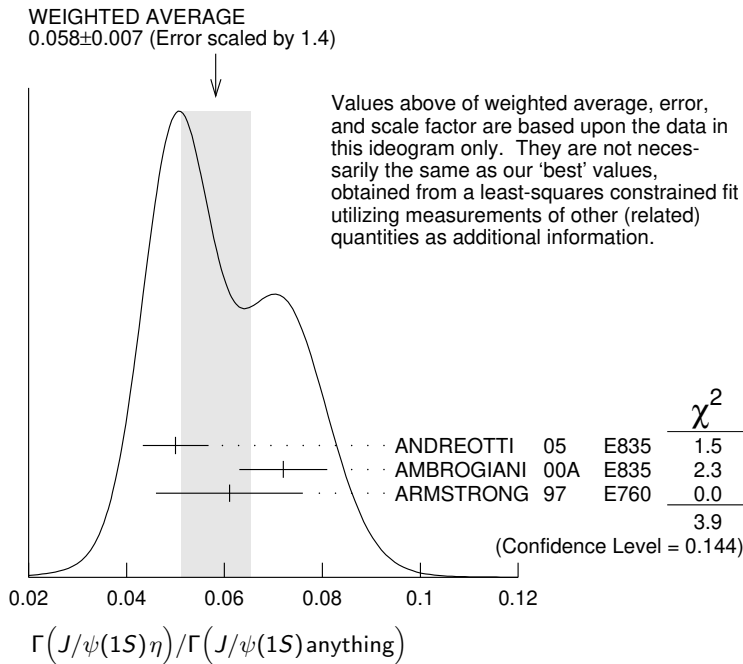
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0549±0.0006±0.0009	18.4k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \eta$
0.0546±0.0010±0.0007	2.8k	ADAM	05A	CLEO	Repl. by MENDEZ 08

- ¹ Not independent from other measurements of MENDEZ 08.

NODE=M071R68;LINKAGE=ME



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{14}/Γ_{12}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0972±0.0016 OUR FIT				Error includes scale factor of 1.1.
0.0979±0.0018 OUR AVERAGE				
0.0979±0.0010±0.0015	18.4k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
0.098 ±0.005 ±0.010	2k	¹ ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
0.091 ±0.021		² HIMEL	80	MRK2 $e^+e^- \rightarrow \psi(2S)X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.0968±0.0019±0.0013	2.8k	³ ADAM	05A	CLEO Repl. by MENDEZ 08
0.095 ±0.007 ±0.007		⁴ ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$

NODE=M071R71
NODE=M071R71

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow J/\psi(1S)\eta)$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

⁴ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71;LINKAGE=AB
NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD
NODE=M071R71;LINKAGE=AN

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{total}$

Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.68±0.32 OUR AVERAGE				
12.6 ±0.2 ±0.3	4.1k	ABLIKIM	12M	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
13.3 ±0.8 ±0.3	530	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-2\gamma$
14.3 ±1.4 ±1.2	280	BAI	04I	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
14 ±6	7	HIMEL	80	MRK2 e^+e^-
9 ±2 ±1	23	¹ OREGLIA	80	CBAL $\psi(2S) \rightarrow J/\psi 2\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
13 ±1 ±1	88	ADAM	05A	CLEO Repl. by MENDEZ 08

NODE=M071R16
NODE=M071R16

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M071R16;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)anything)$

$\Gamma_{15}/\Gamma_{10} = \Gamma_{15}/(\Gamma_{12}+\Gamma_{13}+\Gamma_{14}+0.343\Gamma_{182}+0.195\Gamma_{183})$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.213±0.012±0.003	527	¹ MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
0.22 ±0.02 ±0.01		² ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

NODE=M071S25
NODE=M071S25

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S25;LINKAGE=ME
NODE=M071S25;LINKAGE=AD

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{15}/Γ_{12}

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.380 ± 0.022 ± 0.005	527	¹ MENDEZ	08	CLEO	$e^+e^- \rightarrow J/\psi\gamma\gamma$
0.39 ± 0.04 ± 0.01		² ADAM	05A	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.
² Not independent from other values reported by ADAM 05A.

NODE=M071S26
 NODE=M071S26

NODE=M071S26;LINKAGE=ME
 NODE=M071S26;LINKAGE=AD

NODE=M071310

———— HADRONIC DECAYS ————

$\Gamma(\pi^+\pi^-)/\Gamma_{total}$ Γ_{16}/Γ

VALUE (units 10^{-5}) CL% EVTS DOCUMENT ID TECN COMMENT

0.78 ± 0.26 OUR AVERAGE

0.76 ± 0.25 ± 0.06	30	¹ METREVELI	12		$\psi(2S) \rightarrow \pi^+\pi^-$
8 ± 5		BRANDELIK	79C	DASP	e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.1	90	DOBBS	06A	CLEO	$e^+e^- \rightarrow \psi(2S)$
<5	90	FELDMAN	77	MRK1	e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. Using $\psi(3770) \rightarrow \pi^+\pi^-$ for continuum subtraction.

NODE=M071R20
 NODE=M071R20

NODE=M071R20;LINKAGE=ME

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{17}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.01 ± 0.17 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.

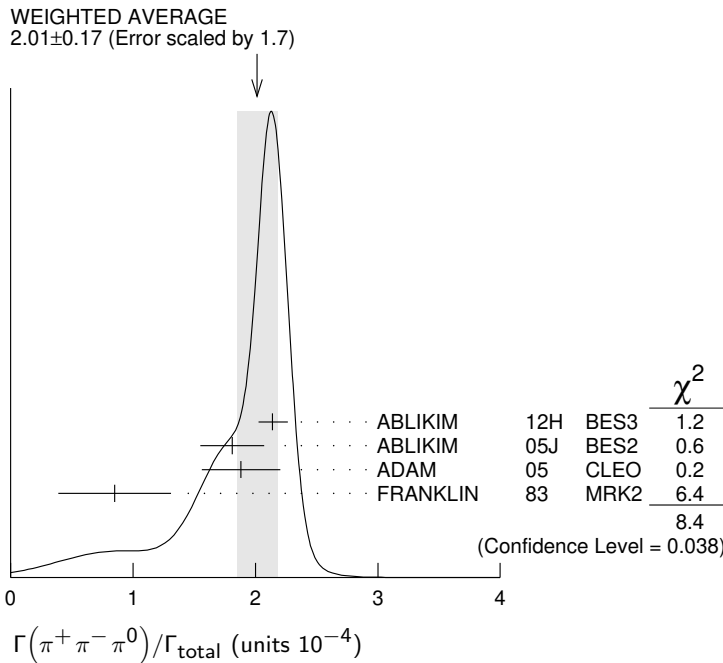
2.14 ± 0.03 ^{+0.12} _{-0.11}	7k	¹ ABLIKIM	12H	BES3	$e^+e^- \rightarrow \psi(2S)$
1.81 ± 0.18 ± 0.19	260 ± 19	² ABLIKIM	05J	BES2	$e^+e^- \rightarrow \psi(2S)$
1.88 ^{+0.16} _{-0.15} ± 0.28	194	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$
0.85 ± 0.46	4	FRANKLIN	83	MRK2	$e^+e^- \rightarrow$ hadrons

¹ From $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$ events directly. The quoted systematic error includes a contribution of 4% (added in quadrature) from the uncertainty on the number of $\psi(2S)$ events.
² From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R36
 NODE=M071R36

NODE=M071R36;LINKAGE=AB

NODE=M071R;LINKAGE=AK



$\Gamma(\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{18}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

0.32 ± 0.12 OUR AVERAGE Error includes scale factor of 1.8.

0.51 ± 0.07 ± 0.11		¹ ABLIKIM	05J	BES2	$\psi(2S) \rightarrow \rho(770)\pi \rightarrow \pi^+\pi^-\pi^0$
0.24 ^{+0.08} _{-0.07} ± 0.02	22	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R26
 NODE=M071R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.83	90	1	FRANKLIN	83	MRK2	e^+e^-
<10	90		BARTEL	76	CNTR	e^+e^-
<10	90	2	ABRAMS	75	MRK1	e^+e^-

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

² Final state $\rho^0\pi^0$.

NODE=M071R26;LINKAGE=AK
NODE=M071R1;LINKAGE=N

$\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{total}$ Γ_{19}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.94 \pm 0.25^{+1.15}_{-0.34}$	¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$

NODE=M071R57
NODE=M071R57

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R57;LINKAGE=AK

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ Γ_{20}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 ± 0.6 OUR AVERAGE				Error includes scale factor of 2.2.
$2.2 \pm 0.2 \pm 0.2$	308	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.5 ± 1.0		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R27
NODE=M071R27

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{total}$ Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.6 OUR AVERAGE				Error includes scale factor of 1.4.
$2.0 \pm 0.2 \pm 0.4$	285.5	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.2 ± 1.5		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R33
NODE=M071R33

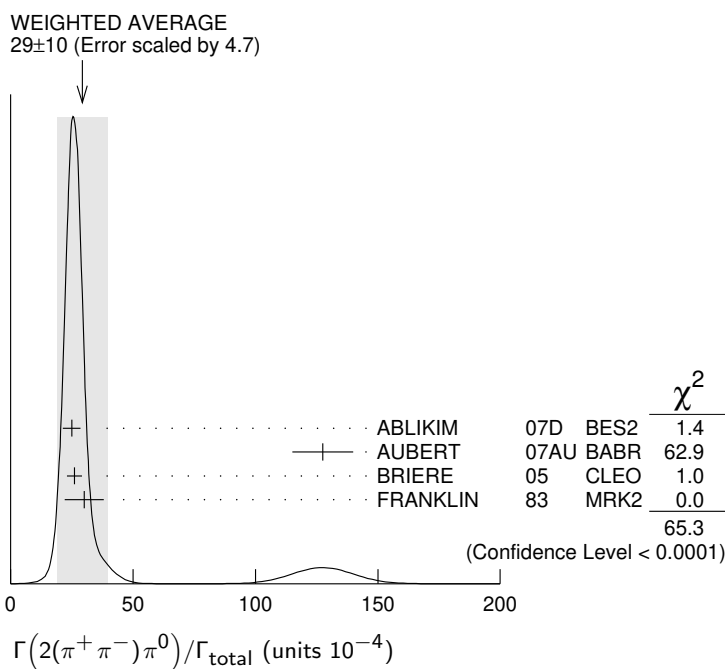
$\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{total}$ Γ_{22}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
29 ± 10 OUR AVERAGE				Error includes scale factor of 4.7. See the ideogram below.
$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
$127 \pm 12 \pm 2$	410	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$
$26.1 \pm 0.7 \pm 3.0$	1703	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
30 ± 8	42	FRANKLIN	83 MRK2	e^+e^-

NODE=M071R22
NODE=M071R22

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{total}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (297 \pm 22 \pm 18) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R22;LINKAGE=UB



$\Gamma(\rho\pi^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.55 ± 0.73 ± 0.47		112 ± 31	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+\pi^-\pi^0)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.3		90	BAI	98J BES	e^+e^-

NODE=M071R65
NODE=M071R65 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ± 2.0 OUR AVERAGE		Error includes scale factor of 2.8.		
5.45 ± 0.42 ± 0.87	671	ABLIKIM	05H BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow 3(\pi^+\pi^-)$
1.5 ± 1.0		¹ TANENBAUM	78 MRK1	e^+e^-

NODE=M071R32
NODE=M071R32¹ Assuming entirely strong decay.

NODE=M071R32;LINKAGE=K

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
35 ± 16	6	FRANKLIN	83 MRK2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M071R37
NODE=M071R37 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-\pi^0)$

NODE=M071S06
NODE=M071S06 $\Gamma(\eta\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
9.5 ± 0.7 ± 1.5		¹ BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
10.3 ± 0.8 ± 1.4	201.7	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$	
8.1 ± 1.4 ± 1.6	50.0	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$	

NODE=M071S07
NODE=M071S07¹ Average of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow 3\pi$.² Not independent from other values reported by BRIERE 05.

OCCUR=2

OCCUR=3

NODE=M071S07;LINKAGE=BR
NODE=M071S07;LINKAGE=BI $\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.1.		
3.0 $^{+1.1}_{-0.9}$ ± 0.2	18	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
1.78 $^{+0.67}_{-0.62}$ ± 0.17	13	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R94
NODE=M071R94 $\Gamma(\eta'\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5 ± 1.6 ± 1.3	12.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$

NODE=M071S08
NODE=M071S08 $\Gamma(\eta'\rho)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.87 $^{+1.64}_{-1.11}$ ± 0.33	2	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.02 ± 0.11 ± 0.24	143	¹ ABLIKIM	17AK BES3	$e^+e^- \rightarrow \psi(2S)$	
0.569 ± 0.128 ± 0.236	80	² ABLIKIM	17AK BES3	$e^+e^- \rightarrow \psi(2S)$	

NODE=M071R93
NODE=M071R93¹ Destructive-interference solution of a partial wave analysis of the decay $\psi(2S) \rightarrow \pi^+\pi^-\eta'$.² Constructive-interference solution of a partial wave analysis of the decay $\psi(2S) \rightarrow \pi^+\pi^-\eta'$.

OCCUR=2

NODE=M071R93;LINKAGE=A

NODE=M071R93;LINKAGE=B

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1 ± 0.6 OUR AVERAGE				
2.5 $^{+1.2}_{-1.0}$ ± 0.2	14	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
1.87 $^{+0.68}_{-0.62}$ ± 0.28	14	ABLIKIM	04L BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R92
NODE=M071R92

$\Gamma(\omega\pi^+\pi^-)/\Gamma_{total}$

Γ_{41}/Γ

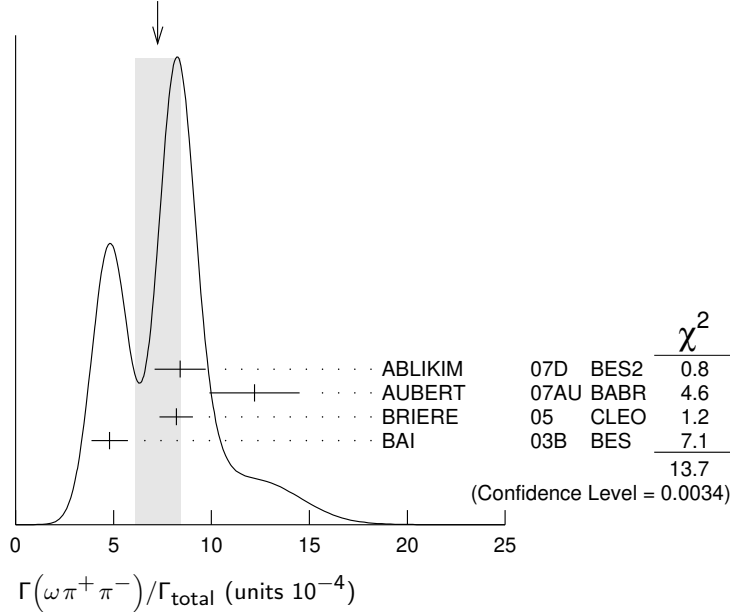
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±1.2 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
8.4±0.5±1.2	386	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
12.2±2.2±0.7	37	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
8.2±0.5±0.7	391	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
4.8±0.6±0.7	100 ± 22	² BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16$ eV.				
² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

NODE=M071R77
NODE=M071R77

NODE=M071R77;LINKAGE=UB

NODE=M071R77;LINKAGE=B3

WEIGHTED AVERAGE
7.3±1.2 (Error scaled by 2.1)



$\Gamma(b_1^\pm\pi^\mp)/\Gamma_{total}$

Γ_{43}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ±0.6 OUR AVERAGE				Error includes scale factor of 1.1.
5.1 ±0.6 ±0.8	202	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
4.18 ^{+0.43} _{-0.42} ±0.92	170	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
3.2 ±0.6 ±0.5	61 ± 11	^{1,2} BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
5.2 ±0.8 ±1.0		¹ BAI	99C BES	Repl. by BAI 03B
¹ Assuming $B(b_1 \rightarrow \omega\pi)=1$.				
² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

NODE=M071R40
NODE=M071R40

NODE=M071R;LINKAGE=M1
NODE=M071R40;LINKAGE=B3

$\Gamma(\omega f_2(1270))/\Gamma_{total}$

Γ_{44}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ±0.4 OUR AVERAGE					
2.3 ±0.5 ±0.4		57	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
2.05±0.41±0.38		62±12	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<1.5		90	¹ BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
<1.7		90	BAI	98J BES	Repl. by BAI 03B
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.					

NODE=M071R64
NODE=M071R64

NODE=M071R64;LINKAGE=B3

$\Gamma(b_1^0\pi^0)/\Gamma_{total}$

Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.47}_{-0.42} ±0.40	45	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R21
NODE=M071R21

$\Gamma(\omega\eta)/\Gamma_{total}$ Γ_{48}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ADAM	05	CLEO $e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<3.1	90	ABLIKIM	04K	BES $e^+e^- \rightarrow \psi(2S)$

NODE=M071R95
NODE=M071R95

$\Gamma(\omega\eta')/\Gamma_{total}$ Γ_{49}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.2^{+2.4}_{-2.0} \pm 0.7$	4	¹ ABLIKIM	04K	BES $e^+e^- \rightarrow \psi(2S)$

NODE=M071R91
NODE=M071R91

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R91;LINKAGE=AI

$\Gamma(\phi\pi^0)/\Gamma_{total}$ Γ_{50}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	ABLIKIM	12L	BES3 $e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	ADAM	05	CLEO $e^+e^- \rightarrow \psi(2S)$
<0.4	90	ABLIKIM	04K	BES $e^+e^- \rightarrow \psi(2S)$

NODE=M071R96
NODE=M071R96

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{total}$ Γ_{51}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.18±0.26 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
2.3 ±0.8 ±0.1	19 ± 6	LEES	12F	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
0.9 ±0.2 ±0.1	47.6	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
1.5 ±0.2 ±0.2	51.5 ± 8.3	¹ BAI	03B	BES $\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.45±0.96±0.04	10 ± 4	^{2,3} AUBERT	07AK	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071R80
NODE=M071R80

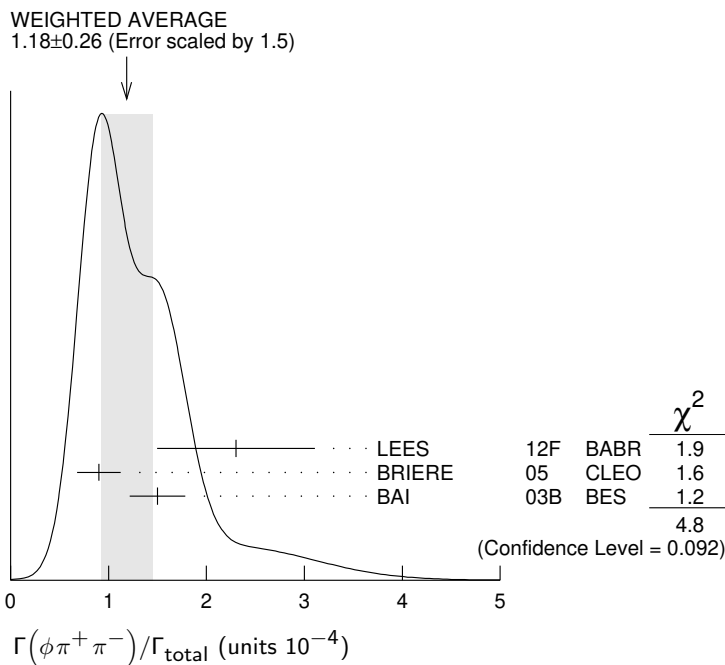
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R80;LINKAGE=B3
NODE=M071R80;LINKAGE=BE

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-)/\Gamma_{total}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (0.57 \pm 0.22 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R80;LINKAGE=UB



$\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{52} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75 ± 0.33 OUR AVERAGE				Error includes scale factor of 1.6.
1.5 ± 0.5 ± 0.1	12 ± 4	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
0.6 ± 0.2 ± 0.1	18.4 ± 6.4	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.46 ± 0.71 ± 0.02	6 ± 3	^{2,3} AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M071R83
NODE=M071R83

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (0.34 \pm 0.16 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R83;LINKAGE=B3
NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB

 $\Gamma(\phi \eta) / \Gamma_{\text{total}}$ Γ_{53} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10 ± 0.31 OUR AVERAGE				
3.14 ± 0.23 ± 0.23	0.2k	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$
2.0 $^{+1.5}_{-1.1}$ ± 0.4	6	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
3.3 ± 1.1 ± 0.5	17	ABLIKIM	04K BES	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R89
NODE=M071R89

 $\Gamma(\eta \phi(2170), \phi(2170) \rightarrow \phi f_0(980), f_0 \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{54} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.2 × 10⁻⁶	90	ABLIKIM	19I BES3	$e^+ e^- \rightarrow \eta \phi f_0(980)$

NODE=M071P19
NODE=M071P19

 $\Gamma(\phi \eta') / \Gamma_{\text{total}}$ Γ_{55} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.54 ± 0.20 OUR AVERAGE				
1.51 ± 0.16 ± 0.12	201	ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$
3.1 ± 1.4 ± 0.7	8	¹ ABLIKIM	04K BES	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R90
NODE=M071R90

¹ Calculated combining $\eta' \rightarrow \gamma \rho$ and $\eta \pi^+ \pi^-$ channels.

NODE=M071R;LINKAGE=AI

 $\Gamma(\phi \phi \phi) / \Gamma_{\text{total}}$ Γ_{56} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.46 ± 0.05 ± 0.17	1.3k	¹ ABLIKIM	24O BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P60
NODE=M071P60

¹ Data at 3.773 GeV assumed to be $e^+ e^- (3.773) \rightarrow 3\phi$ events yield an estimate for the continuum amplitude at the $\psi(2S)$. No interference between the $\psi(2S)$ and continuum amplitudes is assumed.

NODE=M071P60;LINKAGE=A

 $\Gamma(\phi f_1(1285)) / \Gamma_{\text{total}}$ Γ_{57} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.4 ± 1.3	234	¹ ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P22
NODE=M071P22

¹ ABLIKIM 19BA reports $[\Gamma(\psi(2S) \rightarrow \phi f_1(1285)) / \Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow \eta \pi^+ \pi^-)] = (1.03 \pm 0.10 \pm 0.09) \times 10^{-5}$ which we divide by our best value $B(f_1(1285) \rightarrow \eta \pi^+ \pi^-) = (35 \pm 15) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P22;LINKAGE=B

 $\Gamma(\phi \eta(1405) \rightarrow \phi \pi^+ \pi^- \eta) / \Gamma_{\text{total}}$ Γ_{58} / Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
8.46 ± 1.37 ± 0.92	195	ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P24
NODE=M071P24

 $\Gamma(\phi f_2'(1525)) / \Gamma_{\text{total}}$ Γ_{59} / Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.44 ± 0.12 ± 0.11		20 ± 6	BAI	04C	$\psi(2S) \rightarrow 2(K^+ K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.45	90		BAI	98J BES	$e^+ e^- \rightarrow 2(K^+ K^-)$

NODE=M071R67
NODE=M071R67

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.48±0.23±0.39		1.3k	¹ METREVELI	12	$\psi(2S) \rightarrow K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.2 ±1.5 ±0.2		66	^{2,3} LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
8.3 ±1.5 ±0.2		66	^{3,4} LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
6.3 ±0.6 ±0.3			⁵ DOBBS	06A CLEO	e^+e^-
10 ±7			⁵ BRANDELIK	79C DASP	e^+e^-
< 5		90	FELDMAN	77 MRK1	e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² $\sin\phi > 0$.

³ Using $\Gamma(\psi(2S) \rightarrow e^+e^-) = (2.37 \pm 0.04)$ keV.

⁴ $\sin\phi < 0$.

⁵ Interference with non-resonant K^+K^- production not taken into account.

 Γ_{60}/Γ

NODE=M071R23
NODE=M071R23

OCCUR=2

NODE=M071R23;LINKAGE=ME
NODE=M071R23;LINKAGE=A
NODE=M071R23;LINKAGE=B
NODE=M071R23;LINKAGE=C
NODE=M071R23;LINKAGE=BA

 $\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±0.5 OUR AVERAGE				
8.1±1.3±0.3	133	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
7.1±0.3±0.4	817.2	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
16 ±4		¹ TANENBAUM	78 MRK1	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11.0±1.9±0.2	85	² AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Assuming entirely strong decay.

² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$] \times [$\Gamma(\psi(2S) \rightarrow e^+e^-)$] = $(2.56 \pm 0.42 \pm 0.16) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{61}/Γ

NODE=M071R24
NODE=M071R24

NODE=M071R24;LINKAGE=K
NODE=M071R24;LINKAGE=BE

 $\Gamma(K^+K^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.07±0.16±0.26		0.9k	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.9		90	1 FRANKLIN	83 MRK2	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{62}/Γ

NODE=M071R38
NODE=M071R38

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<0.046	¹ BAI	04D BES	e^+e^-

¹ Forbidden by CP.

 Γ_{63}/Γ

NODE=M071R88
NODE=M071R88

NODE=M071R;LINKAGE=BA

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.34±0.33 OUR AVERAGE				
5.28±0.25±0.34	478 ± 23	¹ METREVELI	12	$\psi(2S) \rightarrow K_S^0 K_L^0$
5.8 ±0.8 ±0.4		DOBBS	06A CLEO	e^+e^-
5.24±0.47±0.48	156 ± 14	² BAI	04B BES2	$\psi(2S) \rightarrow K_S^0 K_L^0 \rightarrow \pi^+\pi^-X$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.

 Γ_{64}/Γ

NODE=M071R87
NODE=M071R87

NODE=M071R87;LINKAGE=ME
NODE=M071R;LINKAGE=KZ

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±0.9 OUR AVERAGE				
18.9±5.7±0.3	32	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0\gamma$
11.7±1.0±1.5	597	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\pi^0$
12.7±0.5±1.0	711.6	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+K^-\pi^+\pi^-\pi^0$

¹ AUBERT 07AU reports [$\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$] \times [$\Gamma(\psi(2S) \rightarrow e^+e^-)$] = $(44 \pm 13 \pm 3) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{70}/Γ

NODE=M071S10
NODE=M071S10

NODE=M071S10;LINKAGE=UB

$\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-) / \Gamma_{\text{total}}$ Γ_{71} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.9	19	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S20
 NODE=M071S20

 $\Gamma(K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{72} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±1.3±1.8	238	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S21
 NODE=M071S21

 $\Gamma(K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{73} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±2.2±1.7	133	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S22
 NODE=M071S22

 $\Gamma(K^*(892)^+ K^- \rho^0 + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{74} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±2.2±1.4	78	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S23
 NODE=M071S23

 $\Gamma(K^*(892)^0 K^- \rho^+ + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{75} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±1.3±1.2	125	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S24
 NODE=M071S24

 $\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{76} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.25±0.37	83 ± 9	ABLIKIM	050	BES2 $e^+ e^- \rightarrow \psi(2S)$

NODE=M071R49
 NODE=M071R49

 $\Gamma(K^+ K^- \rho^0) / \Gamma_{\text{total}}$ Γ_{84} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.2±0.4	223.8	BRIERE	05	CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M071S09
 NODE=M071S09

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0) / \Gamma_{\text{total}}$ Γ_{85} / Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.32±0.43		93 ± 16	BAI	04C	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2		90	BAI	98J	BES $e^+ e^-$

NODE=M071R66
 NODE=M071R66

 $\Gamma(K^+ K^- \pi^+ \pi^- \eta) / \Gamma_{\text{total}}$ Γ_{86} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.7±0.1	7	¹ AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^- \eta)) \cdot B(\eta \rightarrow \gamma \gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.				

NODE=M071S39
 NODE=M071S39

NODE=M071S39;LINKAGE=UB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0) / \Gamma_{\text{total}}$ Γ_{88} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.0±2.5±1.8	65	ABLIKIM	07D	BES2 $e^+ e^- \rightarrow \psi(2S)$

NODE=M071R09
 NODE=M071R09

 $\Gamma(K^+ K^*(892)^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{89} / Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2.			
3.18±0.30 ^{+0.26} _{-0.31}		0.2k	ABLIKIM	12L	BES3 $e^+ e^- \rightarrow \psi(2S)$
2.9 ^{+1.3} _{-1.7} ± 0.4		9.6 ± 4.2	ABLIKIM	05I	BES2 $e^+ e^- \rightarrow \psi(2S)$
1.3 ^{+1.0} _{-0.7} ± 0.3		7	ADAM	05	CLEO $e^+ e^- \rightarrow \psi(2S)$

NODE=M071R39
 NODE=M071R39

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5.4		90	FRANKLIN	83	MRK2 $e^+ e^- \rightarrow \text{hadrons}$
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$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**0.63±0.13 OUR AVERAGE**

0.9 ±0.4 ±0.1 13

0.6 ±0.1 ±0.1 59.2

DOCUMENT ID TECN COMMENT

LEES 12F BABR $10.6 e^+ e^- \rightarrow 2(K^+ K^-) \gamma$
 BRIERE 05 CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$

 Γ_{90}/Γ NODE=M071S12
NODE=M071S12 $\Gamma(2(K^+ K^-) \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**1.1±0.2±0.2** 44.7

DOCUMENT ID TECN COMMENT

BRIERE 05 CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-) \pi^0$

 Γ_{91}/Γ NODE=M071S13
NODE=M071S13 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**0.70±0.16 OUR AVERAGE**

0.8 ±0.2 ±0.1 36.8

0.6 ±0.2 ±0.1 16.1 ± 5.0

DOCUMENT ID TECN COMMENT

BRIERE 05 CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$
¹BAI 03B BES $\psi(2S) \rightarrow 2(K^+ K^-)$

 Γ_{92}/Γ NODE=M071R81
NODE=M071R81¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R81;LINKAGE=B3

 $\Gamma(K_S^0 K_S^0 \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**0.353±0.020±0.021** 687

DOCUMENT ID TECN COMMENT

¹ABLIKIM 23BA BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow K_S^0 K_S^0 K^+ K^-$

 Γ_{93}/Γ NODE=M071P53
NODE=M071P53¹ Solution with a constructive interference of the signal with the continuum background.

NODE=M071P53;LINKAGE=A

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**10.0±1.8±2.1**

DOCUMENT ID TECN COMMENT

¹BAI 99C BES $e^+ e^-$

 Γ_{94}/Γ NODE=M071R41
NODE=M071R41¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$

NODE=M071R;LINKAGE=M2

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**6.7±2.5**

DOCUMENT ID TECN COMMENT

TANENBAUM 78 MRK1 $e^+ e^-$

 Γ_{95}/Γ NODE=M071R34
NODE=M071R34 $\Gamma(\eta K^+ K^-, \text{no } \eta \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) CL% EVTS**3.49±0.09±0.15** 1.8k

DOCUMENT ID TECN COMMENT

¹ABLIKIM 20F BES3 $\psi(2S) \rightarrow K^+ K^- \gamma \gamma$

••• We do not use the following data for averages, fits, limits, etc. •••

3.08±0.29±0.25 0.3k ^{1,2}ABLIKIM 12L BES3 $\psi(2S) \rightarrow K^+ K^- \gamma \gamma$ <13 90 BRIERE 05 CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ Γ_{96}/Γ NODE=M071S11
NODE=M071S11¹ Excluding $\eta \phi$.² Superseded by ABLIKIM 20F.NODE=M071S11;LINKAGE=AB
NODE=M071S11;LINKAGE=A $\Gamma(\eta K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$

VALUE (eV) CL%

<0.6 90

DOCUMENT ID TECN COMMENT

¹LEES 23 BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow \eta K^+ K^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] < 0.2 \text{ eV}$ which we divide by our best value $B(\eta \rightarrow 3\pi^0) = 32.56 \times 10^{-2}$. $\Gamma_{97}\Gamma_7/\Gamma$ NODE=M071P57
NODE=M071P57

NODE=M071P57;LINKAGE=A

 $\Gamma(X(1750)\eta \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-6})**4.8±1.0±2.6**

DOCUMENT ID TECN COMMENT

ABLIKIM 20F BES3 $\psi(2S) \rightarrow K^+ K^- \eta$

 Γ_{98}/Γ NODE=M071P28
NODE=M071P28 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%**<3.1** 90

DOCUMENT ID TECN COMMENT

¹BAI 99C BES $e^+ e^-$

 Γ_{99}/Γ NODE=M071R45
NODE=M071R45¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$

NODE=M071R;LINKAGE=M3

$\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$					Γ_{100}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
$7.12 \pm 0.62^{+1.13}_{-0.61}$	251 ± 22	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$		NODE=M071S54 NODE=M071S54
$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{101}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
10.9 ± 2.0 OUR AVERAGE						NODE=M071R30 NODE=M071R30
$13.3^{+2.4}_{-2.8} \pm 1.7$	65.6 ± 9.0	ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$		
$9.2^{+2.7}_{-2.2} \pm 0.9$	25	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$		
$\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$					Γ_{89}/Γ_{101}	
VALUE		DOCUMENT ID	TECN	COMMENT		
0.16 ± 0.06 OUR AVERAGE						NODE=M071R46 NODE=M071R46
$0.22^{+0.10}_{-0.14}$		ABLIKIM	05I BES2	$e^+ e^- \rightarrow \psi(2S)$		
$0.14^{+0.08}_{-0.06}$		ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$		
$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$					Γ_{102}/Γ	
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.62 ± 0.11 OUR AVERAGE		Error includes scale factor of 1.1.				
$1.56 \pm 0.04 \pm 0.11$	2.8k	ABLIKIM	14G BES3	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$		
$2.38 \pm 0.37 \pm 0.29$	78	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$		
$1.9 \pm 0.3 \pm 0.3$	76.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$		
$1.5 \pm 0.3 \pm 0.2$	23	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$		
				¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.		NODE=M071R78;LINKAGE=B3
$\Gamma(\omega K_S^0 K_S^0)/\Gamma_{\text{total}}$					Γ_{103}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
7.04 ± 0.39 ± 0.36	1.5k	ABLIKIM	21AL BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \pi^0 K_S^0 K_S^0$		NODE=M071P34 NODE=M071P34
$\Gamma(\omega K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{104}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
20.7 ± 2.6 OUR AVERAGE						NODE=M071S67 NODE=M071S67
$18.9 \pm 2.9 \pm 2.2$	396	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$		
$22.6 \pm 3.0 \pm 2.4$	535	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$		OCCUR=2
$\Gamma(\omega K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{105}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
6.1 ± 1.2 OUR AVERAGE						NODE=M071S68 NODE=M071S68
$6.39 \pm 1.50 \pm 0.78$	128	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$		
$5.86 \pm 1.61 \pm 0.83$	143	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$		OCCUR=2
$\Gamma(\omega \bar{K}^*(892)^0 K^0)/\Gamma_{\text{total}}$					Γ_{106}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
16.8 ± 2.5 ± 1.6	356	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$		NODE=M071S69 NODE=M071S69
$\Gamma(\omega \bar{K}_2^*(1430)^0 K^0)/\Gamma_{\text{total}}$					Γ_{107}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
5.82 ± 2.08 ± 0.72	116	ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$		NODE=M071S70 NODE=M071S70
$\Gamma(\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{108}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.60 ± 0.27 ± 0.24	109	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$		NODE=M071S71 NODE=M071S71
				¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.		NODE=M071S71;LINKAGE=AB
$\Gamma(\omega X(1440) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$					Γ_{109}/Γ	
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
1.09 ± 0.20 ± 0.16	82	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$		NODE=M071S72 NODE=M071S72
				¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.		NODE=M071S72;LINKAGE=AB

$\Gamma(\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.302±0.098±0.027	22	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

NODE=M071S73
NODE=M071S73

¹ Statistical significance 4.5 σ . This measurement is equivalent to a limit of $< 0.478 \times 10^{-5}$ at 90% C.L.

NODE=M071S73;LINKAGE=AB

 $\Gamma(\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.125±0.070±0.013	10	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

NODE=M071S74
NODE=M071S74

¹ Statistical significance 3.2 σ . This measurement is equivalent to a limit of $< 0.221 \times 10^{-5}$ at 90% C.L.

NODE=M071S74;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.94±0.09 OUR FIT				Error includes scale factor of 1.3.
3.02±0.08 OUR AVERAGE				

NODE=M071R25
NODE=M071R25

3.05±0.02±0.12	19k	ABLIKIM	18T BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
3.08±0.05±0.18	4.5k	¹ DOBBS	14	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
3.36±0.09±0.25	1.6k	ABLIKIM	07C BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.87±0.12±0.15	557	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
1.4 ±0.8	4	BRANDELIK	79C DASP	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.3 ±0.7		FELDMAN	77 MRK1	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R25;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{112}/Γ_{12}

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.49±0.28 OUR FIT			Error includes scale factor of 1.3.
6.98±0.49±0.97	BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

NODE=M071S40
NODE=M071S40

 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$ Γ_{113}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.06±0.06±0.14	6k	ABLIKIM	18T BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow n\bar{n}$

NODE=M071P10
NODE=M071P10

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.53±0.07 OUR AVERAGE				

NODE=M071R35
NODE=M071R35

1.65±0.03±0.15	4.5k	ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$
1.54±0.06±0.06	948	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \pi^0 p\bar{p}$
1.32±0.10±0.15	256	¹ ABLIKIM	05E BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\gamma\gamma$
1.4 ±0.5	9	FRANKLIN	83 MRK2	$e^+ e^-$

¹ Computed using $B(\pi^0 \rightarrow \gamma\gamma) = (98.80 \pm 0.03)\%$.

NODE=M071R35;LINKAGE=AB

 $\Gamma(N(940)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{115}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.42±0.20^{+1.78}_{-1.28}	1.9k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$

NODE=M071S56
NODE=M071S56

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S56;LINKAGE=AB

 $\Gamma(N(1440)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3^{+1.7}_{-1.5} OUR AVERAGE				Error includes scale factor of 2.5.

NODE=M071S50
NODE=M071S50

3.58±0.25 ^{+1.59} _{-0.84}	1.1k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$
8.1 ±0.7 ±0.3	474	² ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \pi^0 p\bar{p}$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S50;LINKAGE=AB

² From a fit of the $p\bar{p}$ and $p\pi^0$ mass distributions to a combination of $N(1440)\bar{p}$, a broad $p\bar{p}$ enhancement around 2100 MeV, and two other broad, unestablished resonances.

NODE=M071S50;LINKAGE=AL

 $\Gamma(N(1520)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{117}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.64±0.05^{+0.22}_{-0.17}	0.2k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$

NODE=M071S57
NODE=M071S57

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S57;LINKAGE=AB

$\Gamma(N(1535)\bar{p} + c.c. \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.47 \pm 0.28^{+0.99}_{-0.97}$	0.7k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow \rho\bar{p}\pi^0$

NODE=M071S58
NODE=M071S58¹ From a fit of $\pi^0 \rho\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S58;LINKAGE=AB

 $\Gamma(N(1650)\bar{p} + c.c. \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.76 \pm 0.28^{+1.37}_{-1.66}$	1.1k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow \rho\bar{p}\pi^0$

NODE=M071S59
NODE=M071S59¹ From a fit of $\pi^0 \rho\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S59;LINKAGE=AB

 $\Gamma(N(1720)\bar{p} + c.c. \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{120}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.79 \pm 0.10^{+0.24}_{-0.71}$	0.5k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow \rho\bar{p}\pi^0$

NODE=M071S60
NODE=M071S60¹ From a fit of $\pi^0 \rho\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S60;LINKAGE=AB

 $\Gamma(N(2300)\bar{p} + c.c. \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{121}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.62 \pm 0.28^{+1.12}_{-0.64}$	0.9k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow \rho\bar{p}\pi^0$

NODE=M071S61
NODE=M071S61¹ From a fit of $\pi^0 \rho\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S61;LINKAGE=AB

 $\Gamma(N(2570)\bar{p} + c.c. \rightarrow \rho\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{122}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.13 \pm 0.08^{+0.40}_{-0.30}$	0.8k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow \rho\bar{p}\pi^0$

NODE=M071S62
NODE=M071S62¹ From a fit of $\pi^0 \rho\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S62;LINKAGE=AB

 $\Gamma(\rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{123}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				
$5.9 \pm 0.2 \pm 0.4$	904.5	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-$
8 ± 2		¹ TANENBAUM	78 MRK1	e^+e^-

NODE=M071R31
NODE=M071R31¹ Assuming entirely strong decay.

NODE=M071R;LINKAGE=K

 $\Gamma(\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{124}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.7 \pm 0.6 \pm 0.4$	30.1	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}K^+K^-$

NODE=M071S16
NODE=M071S16 $\Gamma(\rho\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				
$6.4 \pm 0.2 \pm 0.6$	679	¹ ABLIKIM	13S BES3	$\psi(2S) \rightarrow \eta\rho\bar{p}$
$5.6 \pm 0.6 \pm 0.3$	154	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta\rho\bar{p}$
$5.8 \pm 1.1 \pm 0.7$	44.8 ± 8.5	² ABLIKIM	05E BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\gamma\gamma$
$8 \pm 3 \pm 3$	9.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-\pi^0$

NODE=M071R56
NODE=M071R56¹ With $N(1535)$ decaying to $\rho\eta$.² Computed using $B(\eta \rightarrow \gamma\gamma) = (39.43 \pm 0.26)\%$.NODE=M071R56;LINKAGE=A
NODE=M071R56;LINKAGE=AB $\Gamma(N(1535)\bar{p} + c.c. \rightarrow \rho\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{126}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.7 OUR AVERAGE				
$5.2 \pm 0.3^{+3.2}_{-1.2}$	527	¹ ABLIKIM	13S BES3	$\psi(2S) \rightarrow \eta\rho\bar{p}$
$4.4 \pm 0.6 \pm 0.3$	123	² ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta\rho\bar{p}$

NODE=M071S53
NODE=M071S53¹ With $N(1535)$ decaying to $\rho\eta$.² From a fit of the $\rho\bar{p}$ and $\rho\eta$ distributions to a combination of $N^*(1535)\bar{p}$ and a broad $\rho\bar{p}$ enhancement around 2100 MeV.NODE=M071S53;LINKAGE=A
NODE=M071S53;LINKAGE=AL

$\Gamma(\rho\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
7.3±0.4±0.6	434.9

DOCUMENT ID	TECN	COMMENT
BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-\pi^0$

 Γ_{127}/Γ NODE=M071S15
NODE=M071S15 $\Gamma(\rho\bar{p}\rho^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
0.5±0.1±0.2	61.1

DOCUMENT ID	TECN	COMMENT
BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-$

 Γ_{128}/Γ NODE=M071S14
NODE=M071S14 $\Gamma(\rho\bar{p}\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
0.69±0.21 OUR AVERAGE	

0.6 ±0.2 ±0.2	21.2
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DOCUMENT ID	TECN	COMMENT
BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-\pi^0$

 Γ_{129}/Γ NODE=M071R79
NODE=M071R79

0.8 ±0.3 ±0.1	14.9 ±0.1
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¹ BAI	03B	BES $\psi(2S) \rightarrow \rho\bar{p}\pi^+\pi^-\pi^0$
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¹Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R;LINKAGE=B3

 $\Gamma(\rho\bar{p}\eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS
1.10±0.10±0.08	491

DOCUMENT ID	TECN	COMMENT
¹ ABLIKIM	19N	BES3 $\psi(2S) \rightarrow \eta'\rho\bar{p}$

 Γ_{130}/Γ NODE=M071P20
NODE=M071P20¹From the combination of $\rho\bar{p}\eta' \rightarrow \rho\bar{p}\pi^+\pi^-\eta$ and $\rho\bar{p}\eta' \rightarrow \rho\bar{p}\pi^+\pi^-\gamma$ channels.

NODE=M071P20;LINKAGE=A

 $\Gamma(\rho\bar{p}\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS
6.06±0.38±0.48		753

DOCUMENT ID	TECN	COMMENT
ABLIKIM	19A0	BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}K^+K^-$

 Γ_{131}/Γ NODE=M071R82
NODE=M071R82

• • • We do not use the following data for averages, fits, limits, etc. • • •

<24	90
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BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}K^+K^-$
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<26	90
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¹ BAI	03B	BES $\psi(2S) \rightarrow K^+K^-\rho\bar{p}$
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¹Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R82;LINKAGE=B3

 $\Gamma(\phi X(1835) \rightarrow \rho\bar{p}\phi)/\Gamma_{\text{total}}$

VALUE	CL%
<1.82 × 10⁻⁷	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM	19A0	BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{p}K^+K^-$

 Γ_{132}/Γ NODE=M071P21
NODE=M071P21 $\Gamma(\rho\bar{n}\pi^- \text{ or c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
2.48±0.17 OUR AVERAGE	

2.45±0.11±0.21	851
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ABLIKIM	06I	BES2 $e^+e^- \rightarrow \rho\pi^-X$
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 Γ_{133}/Γ NODE=M071R01
NODE=M071R01

2.52±0.12±0.22	849
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ABLIKIM	06I	BES2 $e^+e^- \rightarrow \bar{p}\pi^+X$
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OCCUR=2

 $\Gamma(\rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
3.18±0.50±0.50	135 ± 21

DOCUMENT ID	TECN	COMMENT
ABLIKIM	06I	BES2 $e^+e^- \rightarrow \rho\pi^-\pi^0X$

 Γ_{134}/Γ NODE=M071R02
NODE=M071R02 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS
3.81±0.13 OUR AVERAGE		

3.97±0.02±0.12	31k
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ABLIKIM	17L	BES3 $e^+e^- \rightarrow \Lambda\bar{\Lambda}$
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3.71±0.05±0.15	6.5k
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¹ DOBBS	17	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
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3.39±0.20±0.32	337
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ABLIKIM	07C	BES $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
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6.4 ±1.8 ±0.1	
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² AUBERT	07BD	BABR 10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
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3.28±0.23±0.25	208
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PEDLAR	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.75±0.09±0.23	1.9k
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^{1,3} DOBBS	14	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
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1.81±0.20±0.27	80
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⁴ BAI	01	BES $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
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< 4	90
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FELDMAN	77	MRK1 $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
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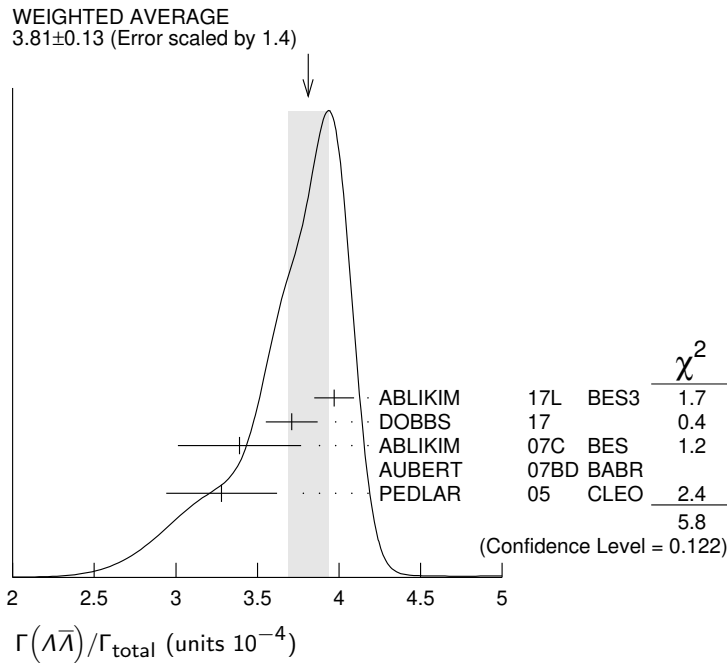
 Γ_{135}/Γ NODE=M071R28
NODE=M071R28

Error includes scale factor of 1.4. See the ideogram below.

- ¹ Using CLEO-c data but not authored by the CLEO Collaboration.
² AUBERT 07BD reports $[\Gamma(\psi(2S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (15 \pm 4 \pm 1) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.
³ Superseded by DOBBS 17.
⁴ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R28;LINKAGE=A
 NODE=M071R28;LINKAGE=AU

NODE=M071R28;LINKAGE=B
 NODE=M071R28;LINKAGE=PP



$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{136}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.42 \pm 0.39 \pm 0.59$		23	¹ ABLIKIM 22AP	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
●●● We do not use the following data for averages, fits, limits, etc. ●●●					
< 2.9	90		² ABLIKIM 13F	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
< 120	90		³ ABLIKIM 07H	BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R6
 NODE=M071R6

¹ With a significance of 3.7 σ . The corresponding 90% CL upper limit is 2.47×10^{-6} .

² Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.

³ Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M071R6;LINKAGE=A
 NODE=M071R6;LINKAGE=AL
 NODE=M071R6;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{137}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.43 ± 0.32 OUR AVERAGE					
$2.34 \pm 0.18 \pm 0.52$		218	ABLIKIM 22AP	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
$2.48 \pm 0.34 \pm 0.19$		60	¹ ABLIKIM 13F	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
●●● We do not use the following data for averages, fits, limits, etc. ●●●					
< 4.9	90		² ABLIKIM 07H	BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R7
 NODE=M071R7

¹ Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.

² Using $B(\Lambda \rightarrow \pi^-p) = 63.9\%$.

NODE=M071R7;LINKAGE=AL
 NODE=M071R7;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\eta')/\Gamma_{\text{total}}$ Γ_{139}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.34 \pm 0.94 \pm 0.43$	218	ABLIKIM 23BV	BES3	$\psi(2S) \rightarrow p\bar{p}2(\pi^+\pi^-)\gamma(\gamma)$

NODE=M071P52
 NODE=M071P52

$\Gamma(\Lambda\bar{\Lambda}\omega(782))/\Gamma_{\text{total}}$ Γ_{140}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.30 \pm 0.34 \pm 0.29$	207	¹ ABLIKIM 22AZ	BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P46
 NODE=M071P46

¹ Using $B(\Lambda \rightarrow \pi^-p) = 0.639$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.893$.

OCCUR=2
 NODE=M071P46;LINKAGE=B

$\Gamma(\Lambda(1670)\bar{\Lambda} \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{138}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.29 \pm 0.31 \pm 0.62$	116	¹ ABLIKIM 22AP	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$

NODE=M071P42
 NODE=M071P42

¹ From a partial wave analysis of the $\Lambda\eta$ system.

NODE=M071P42;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{141}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.8±0.4±0.5	73.4	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}2(\pi^+\pi^-)$	NODE=M071S17 NODE=M071S17

$\Gamma(\Lambda\bar{\rho}K^+)/\Gamma_{\text{total}}$					Γ_{142}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.0±0.1±0.1	74.0	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}K^+\pi^-$	NODE=M071S18 NODE=M071S18

$\Gamma(\Lambda\bar{\rho}K^*(892)^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{143}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
6.3±0.5±0.5	1011	ABLIKIM	19AU BES3	$e^+e^- \rightarrow \psi(2S)$	NODE=M071P25 NODE=M071P25

$\Gamma(\Lambda\bar{\rho}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{144}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.8±0.3±0.3	45.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}K^+\pi^+\pi^-\pi^-$	NODE=M071S19 NODE=M071S19

$\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{145}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.81±0.11±0.14	50	¹ ABLIKIM	08C BES2	$e^+e^- \rightarrow J/\psi$	NODE=M071R08 NODE=M071R08

¹ Using $B(\bar{\Lambda} \rightarrow \bar{\rho}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.

NODE=M071R08;LINKAGE=AB

$\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$					Γ_{146}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
12.8±1.0±3.4	157	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	NODE=M071R50 NODE=M071R50

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R50;LINKAGE=PP

$\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{147}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.40±0.03±0.13	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow$ hadrons	NODE=M071S65 NODE=M071S65

$\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{148}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.54±0.04±0.13	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow$ hadrons	NODE=M071S66 NODE=M071S66

$\Gamma(\Lambda\bar{\Sigma}^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{149}/Γ
VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.60±0.31±0.59	60	ABLIKIM	21L BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	NODE=M071P29 NODE=M071P29

$\Gamma(\Lambda\bar{\Sigma}^0)/\Gamma_{\text{total}}$					Γ_{150}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT		
• • •					
1.23±0.23±0.08	30	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	NODE=M071P08 NODE=M071P08

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071P08;LINKAGE=A

$\Gamma(\Sigma^0\bar{\rho}K^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{151}/Γ
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	
1.67±0.13±0.12	276	¹ ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\rho}K^+$	NODE=M071S63 NODE=M071S63

¹ Using $B(\Lambda \rightarrow \rho\pi^-) = 63.9\%$, and $B(\Sigma^0 \rightarrow \Lambda\gamma) = 100\%$.

NODE=M071S63;LINKAGE=AB

$\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$					Γ_{152}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.43±0.10 OUR AVERAGE		Error includes scale factor of 1.4.			
2.52±0.04±0.09	5.4k	ABLIKIM	21AT BES3	$\psi(2S) \rightarrow \rho\pi^0\bar{\rho}\pi^0$	
2.31±0.06±0.10	1.9k	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	
2.57±0.44±0.68	35	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons	

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.51±0.15±0.16 281 ^{1,2} DOBBS 14 $e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.NODE=M071R47
NODE=M071R47NODE=M071R47;LINKAGE=A
NODE=M071R47;LINKAGE=B

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{153}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35±0.09 OUR AVERAGE		Error includes scale factor of 1.1.		
2.44±0.03±0.11	7k	ABLIKIM	17L BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.22±0.05±0.11	2.6k	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.35±0.36±0.32	59	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.63±0.35±0.21	58	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.25±0.11±0.16	439	^{1,2} DOBBS	14	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
1.2 ±0.4 ±0.4	8	³ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R51
NODE=M071R51¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.³ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R51;LINKAGE=A
NODE=M071R51;LINKAGE=B
NODE=M071R51;LINKAGE=PP $\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{154}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82±0.04±0.08	6.6k	ABLIKIM	22AV BES3	$\psi(2S) \rightarrow n\pi^- \bar{n}\pi^+$

NODE=M071P41
NODE=M071P41 $\Gamma(\Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}$ Γ_{155}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
9.59±2.37±0.61	21	ABLIKIM	22AY BES3	$\psi(2S) \rightarrow \Sigma^+ \bar{\Sigma}^- \eta$

NODE=M071P45
NODE=M071P45 $\Gamma(\Sigma^+ \bar{\Sigma}^- \omega)/\Gamma_{\text{total}}$ Γ_{156}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.89±0.18±0.21	199	ABLIKIM	23BE BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P50
NODE=M071P50 $\Gamma(\Sigma^+ \bar{\Sigma}^- \phi)/\Gamma_{\text{total}}$ Γ_{157}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.96±0.54±0.41	55	ABLIKIM	23BE BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P51
NODE=M071P51 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{158}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5±0.7 OUR AVERAGE		Error includes scale factor of 1.1.		
8.4±0.5±0.5	1.5k	ABLIKIM	16L BES3	$\psi(2S) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-$
11 ±3 ±3	14	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R52
NODE=M071R52

OCCUR=2

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R52;LINKAGE=PP

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{159}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5±0.6±0.6	1.4k	ABLIKIM	16L BES3	$\psi(2S) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+$

NODE=M071R00
NODE=M071R00 $\Gamma(\Sigma(1385)^0 \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$ Γ_{160}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69±0.05±0.05	2.2k	ABLIKIM	17E BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P00
NODE=M071P00 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{161}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±0.11 OUR AVERAGE			Error includes scale factor of 1.1.		
3.03±0.05±0.14	3.6k	¹ DOBBS	17		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.78±0.05±0.14	5k	ABLIKIM	16L BES3		$\psi(2S) \rightarrow \Xi^- \bar{\Xi}^+$
3.03±0.40±0.32	67	ABLIKIM	07C BES		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.38±0.30±0.21	63	PEDLAR	05 CLEO		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.66±0.12±0.20	548	^{1,2} DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
0.94±0.27±0.15	12	³ BAI	01 BES		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
<2	90	FELDMAN	77 MRK1		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R29
NODE=M071R29¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.³ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R29;LINKAGE=A
NODE=M071R29;LINKAGE=B
NODE=M071R29;LINKAGE=PP

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.4 OUR AVERAGE		Error includes scale factor of 4.2.		
2.73 ± 0.03 ± 0.13	11k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
1.97 ± 0.06 ± 0.11	1.2k	¹ DOBBS	17	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.75 ± 0.64 ± 0.61	19	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.02 ± 0.19 ± 0.15	112	^{1,2} DOBBS	14	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17. Γ_{162}/Γ NODE=M071R48
NODE=M071R48 $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.77 ± 0.14 ± 0.39		2951	ABLIKIM	21A0 BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 32	90		PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 8.1	90		¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$. Γ_{163}/Γ NODE=M071R53
NODE=M071R53 $\Gamma(\Lambda \Xi^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.67 ± 0.22 OUR AVERAGE		[(3.9 ± 0.4) × 10 ⁻⁵ OUR 2024 AVERAGE]		
3.60 ± 0.10 ± 0.24	1572	ABLIKIM	24N BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$
3.86 ± 0.27 ± 0.32	236	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

 Γ_{164}/Γ NODE=M071S82
NODE=M071S82
NEW $\Gamma(\Xi(1530)^- \Xi(1530)^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
11.45 ± 0.40 ± 0.59	5k	ABLIKIM	19AT BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{167}/Γ NODE=M071P26
NODE=M071P26 $\Gamma(\Xi(1530)^- \Xi^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0 ± 1.1 ± 0.4	399	ABLIKIM	19AT BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{168}/Γ NODE=M071P27
NODE=M071P27 $\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.53 ± 0.04 ± 0.03	278	ABLIKIM	21A0 BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{169}/Γ NODE=M071P35
NODE=M071P35 $\Gamma(\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.2 ± 2.1 OUR AVERAGE		Error includes scale factor of 1.5. [(5.2 ± 1.6) × 10 ⁻⁶ OUR 2024 AVERAGE]		
10.6 ± 1.0 ± 3.1	464	ABLIKIM	24N BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$
5.21 ± 1.48 ± 0.57	74	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

 Γ_{165}/Γ NODE=M071S83
NODE=M071S83
NEW $\Gamma(\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
14.8 ± 2.9 OUR AVERAGE		Error includes scale factor of 1.2. [(12.0 ± 3.2) × 10 ⁻⁶ OUR 2024 AVERAGE]		
17.8 ± 1.0 ± 3.2	776	ABLIKIM	24N BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$
12.03 ± 2.94 ± 1.22	136	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

 Γ_{166}/Γ NODE=M071S84
NODE=M071S84
NEW $\Gamma(\Sigma^0 \Xi^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.67 ± 0.33 ± 0.28	142	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Sigma^0 \Xi^+ + \text{c.c.}$

 Γ_{170}/Γ NODE=M071S85
NODE=M071S85

$\Gamma(\Omega^- K^+ \Xi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{171}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.78 ± 0.40 ± 0.18	242	ABLIKIM	24AG BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P62
 NODE=M071P62

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.66 ± 0.30 OUR AVERAGE			Error includes scale factor of 1.3.		

NODE=M071R54
 NODE=M071R54

5.85 ± 0.12 ± 0.25	4k	¹ ABLIKIM	21E BES3	$\psi(2S) \rightarrow \Omega^- \bar{\Omega}^+ \rightarrow$
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5.2 ± 0.3 ± 0.3	326	^{1,2} DOBBS	17	$\Lambda K^- \bar{\Lambda} K^+$ $e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.7 ± 0.9 ± 0.5	27	^{1,2,3} DOBBS	14	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
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<15	90	ABLIKIM	12Q BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
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<16	90	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
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< 7.3	90	⁴ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ hadrons
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¹ Using $B(\Omega^- \rightarrow \Lambda K^-) = (67.8 \pm 0.7)\%$ and $B(\Lambda \rightarrow p \pi^-) = (63.9 \pm 0.5)\%$.

² Using CLEO-c data but not authored by the CLEO Collaboration.

³ Superseded by DOBBS 17.

⁴ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R54;LINKAGE=D
 NODE=M071R54;LINKAGE=A
 NODE=M071R54;LINKAGE=B
 NODE=M071R54;LINKAGE=PP

 $\Gamma(\eta_c \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{173}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	PEDLAR	07 CLEO	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R03
 NODE=M071R03

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{174}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.4 ± 0.5 OUR AVERAGE				

NODE=M071S42
 NODE=M071S42

7.32 ± 0.34 ± 0.41	46k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons
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9.0 ± 1.5 ± 1.3	3k	¹ GE	11 CLEO	$\psi(2S) \rightarrow \pi^0$ anything
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• • • We do not use the following data for averages, fits, limits, etc. • • •

8.4 ± 1.3 ± 1.0	11k	² ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 h_c$
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seen	92 ⁺²³ ₋₂₂	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2\pi^+ 2\pi^- 2\pi^0$
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seen	1282	DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
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seen	168 ± 40	ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
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¹ Assuming a width $\Gamma(h_c(1P)) = 0.86 \text{ MeV} \equiv \Gamma_0$, a measured dependence of the central value of $B = (7.6 + 1.4 \times \Gamma(h_c(1P))/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

² Superseded by ABLIKIM 22AQ

NODE=M071S42;LINKAGE=GE

NODE=M071S42;LINKAGE=A

 $\Gamma(\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{175}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.7 × 10⁻⁶	90	450M	ABLIKIM	18Q BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P11
 NODE=M071P11

 $\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{176}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S01
 NODE=M071S01

 $\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{177}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S02
 NODE=M071S02

 $\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{178}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.70	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S03
 NODE=M071S03

 $\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{179}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S04
 NODE=M071S04

$\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}) / \Gamma_{\text{total}}$ Γ_{180} / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.60	90	BAI	04G BES2	$e^+ e^-$

NODE=M071S05
 NODE=M071S05

RADIATIVE DECAYS

 $\Gamma(\gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$ Γ_{181} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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9.75 ± 0.22 OUR FIT Error includes scale factor of 1.1. [(9.77 ± 0.23) × 10⁻² OUR 2024 FIT Scale factor = 1.1]

NODE=M071315

NODE=M071R55
 NODE=M071R55

NEW

9.33 ± 0.26 OUR AVERAGE

9.389 ± 0.014 ± 0.332	4.7M	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
9.22 ± 0.11 ± 0.46	72k	ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
9.9 ± 0.5 ± 0.8		¹ GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$
7.2 ± 2.3		¹ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
7.5 ± 2.6		¹ WHITAKER	76 MRK1	$e^+ e^-$

¹ Angular distribution (1 + cos²θ) assumed.

NODE=M071R;LINKAGE=A

 $\Gamma(\gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$ Γ_{182} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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9.75 ± 0.27 OUR FIT Error includes scale factor of 1.1.

NODE=M071R58
 NODE=M071R58

9.54 ± 0.29 OUR AVERAGE

9.905 ± 0.011 ± 0.353	5.0M	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
9.07 ± 0.11 ± 0.54	76k	ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
9.0 ± 0.5 ± 0.7		¹ GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$
7.1 ± 1.9		² BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$

¹ Angular distribution (1 - 0.189 cos²θ) assumed.

² Valid for isotropic distribution of the photon.

NODE=M071R;LINKAGE=G
 NODE=M071R;LINKAGE=B

 $\Gamma(\gamma \chi_{c0}(1P)) / \Gamma(\gamma \chi_{c1}(1P))$ $\Gamma_{181} / \Gamma_{182}$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.02 ± 0.01 ± 0.07	¹ ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
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¹ Not independent from ATHAR 04 measurements of B(γχ_{cJ}).

NODE=M071R97
 NODE=M071R97

NODE=M071R97;LINKAGE=AH

 $\Gamma(\gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$ Γ_{183} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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9.38 ± 0.23 OUR FIT Error includes scale factor of 1.2. [(9.36 ± 0.23) × 10⁻² OUR 2024 FIT Scale factor = 1.2]

NODE=M071R59
 NODE=M071R59

NEW

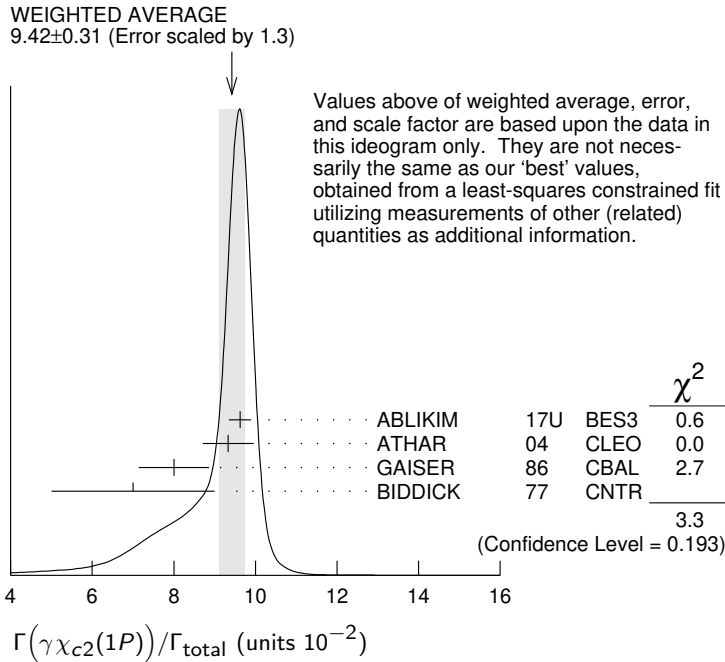
9.42 ± 0.31 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

9.621 ± 0.013 ± 0.272	4.2M	ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$
9.33 ± 0.14 ± 0.61	79k	ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
8.0 ± 0.5 ± 0.7		¹ GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$
7.0 ± 2.0		² BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$

¹ Angular distribution (1 - 0.052 cos²θ) assumed.

² Valid for isotropic distribution of the photon.

NODE=M071R;LINKAGE=F
 NODE=M071R59;LINKAGE=B



$$\frac{[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]}{\Gamma_{\text{total}}} \quad \frac{(\Gamma_{181} + \Gamma_{182} + \Gamma_{183})}{\Gamma}$$

VALUE	DOCUMENT ID	TECN	COMMENT
27.6 ± 0.3 ± 2.0	¹ ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.

NODE=M071R19
NODE=M071R19

NODE=M071R;LINKAGE=AH

$$\frac{\Gamma(\gamma\chi_{c0}(1P))}{\Gamma(\gamma\chi_{c2}(1P))} \quad \frac{\Gamma_{181}}{\Gamma_{183}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.99 ± 0.02 ± 0.08	¹ ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.

NODE=M071R99
NODE=M071R99

NODE=M071R99;LINKAGE=AH

$$\frac{\Gamma(\gamma\chi_{c2}(1P))}{\Gamma(\gamma\chi_{c1}(1P))} \quad \frac{\Gamma_{183}}{\Gamma_{182}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.03 ± 0.02 ± 0.03	¹ ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.

NODE=M071R98
NODE=M071R98

NODE=M071R98;LINKAGE=AH

$$\frac{\Gamma(\gamma\eta_c(1S))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{184}}{\Gamma}$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.05 OUR FIT				Error includes scale factor of 1.3.
0.34 ± 0.05 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.432 ± 0.016 ± 0.060		MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
0.32 ± 0.04 ± 0.06	2.5k	¹ ATHAR	04 CLEO	$e^+ e^- \rightarrow \gamma X$
0.28 ± 0.06		² GAISER	86 CBAL	$e^+ e^- \rightarrow \gamma X$

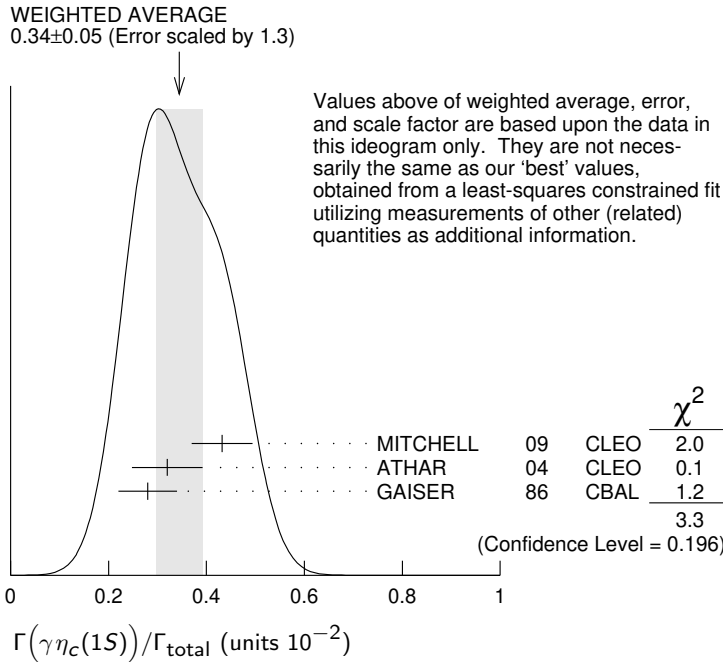
NODE=M071R60
NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

¹ ATHAR 04 used $\Gamma_{\eta_c(1S)} = 24.8 \pm 4.9$ MeV to obtain this result.

² GAISER 86 used $\Gamma_{\eta_c(1S)} = 11.5 \pm 4.5$ MeV to obtain this result.



$\Gamma(\gamma\eta_c(2S))/\Gamma_{total}$ Γ_{185}/Γ

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

5.4^{+3.4}_{-2.9} OUR FIT

••• We do not use the following data for averages, fits, limits, etc. •••

5.1±0.6 ^{+2.7} _{-3.1}	1.6k	1	ABLIKIM	24J	BES3	$\psi(2S) \rightarrow \gamma\eta_c \rightarrow \gamma K \bar{K} \pi$
7 ±2 ±4		2	ABLIKIM	12G	BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
< 8	90	3	CRONIN-HEN..10	CLEO		$\psi(2S) \rightarrow \gamma K \bar{K} \pi$
<20	90		ATHAR	04	CLEO	$e^+ e^- \rightarrow \gamma X$
20-130	95		EDWARDS	82C	CBAL	$e^+ e^- \rightarrow \gamma X$

- 1 ABLIKIM 24J reports $[\Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{total}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] = (0.97 \pm 0.06 \pm 0.09) \times 10^{-5}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = (1.9^{+1.2}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 2 ABLIKIM 12G reports $[\Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{total}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] = (1.30 \pm 0.20 \pm 0.30) \times 10^{-5}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = (1.9^{+1.2}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- 3 CRONIN-HENNESSY 10 reports $[\Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{total}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] < 14.5 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = 1.9 \times 10^{-2}$. This measurement assumes $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M071R62
NODE=M071R62

NODE=M071R62;LINKAGE=A

NODE=M071R62;LINKAGE=AB

NODE=M071R62;LINKAGE=CR

$\Gamma(\gamma\pi^0)/\Gamma_{total}$ Γ_{186}/Γ

VALUE (units 10^{-7}) CL% EVTS DOCUMENT ID TECN COMMENT

2.7 to 9.7	68	1	ABLIKIM	24BS	BES3	$\psi(2S) \rightarrow \gamma\pi^0$
9.5±1.6±0.5	423	2	ABLIKIM	17X	BES3	$\psi(2S) \rightarrow \gamma\pi^0$
15.8±4.0±1.3	37	2	ABLIKIM	10F	BES3	$\psi(2S) \rightarrow \gamma\pi^0$
< 50	90		PEDLAR	09	CLE3	$\psi(2S) \rightarrow \gamma X$
< 54000	95	3	LIBERMAN	75	SPEC	$e^+ e^-$
<100000	90		WIJK	75	DASP	$e^+ e^-$

- 1 Taking into account interference between $\psi(2S)$ and continuum amplitudes. Range of the 1σ contour in the plane of $B(\psi(2S) \rightarrow \gamma\pi^0)$ versus ϕ , the relative phase of the amplitudes. The fit provides two solutions for $B(\psi(2S) \rightarrow \gamma\pi^0)$: 3.74×10^{-7} ($\phi = 3.93$ rad) and 7.87×10^{-7} ($\phi = 2.08$ rad).
- 2 Interference between $\psi(2S)$ and the continuum is not taken into account.
- 3 Restated by us using $B(\psi(2S) \rightarrow \mu^+ \mu^-) = 0.0077$.

NODE=M071R42
NODE=M071R42

NODE=M071R42;LINKAGE=A

NODE=M071R42;LINKAGE=B
NODE=M071R;LINKAGE=U

$\Gamma(\gamma 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$			Γ_{187}/Γ			
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
39.6 ± 2.8 ± 5.0	583	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$		NODE=M071S28 NODE=M071S28

$\Gamma(\gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$			Γ_{188}/Γ			
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT		
<17	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$		NODE=M071S36 NODE=M071S36

$\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$			Γ_{189}/Γ			
VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
1.24 ± 0.04 OUR AVERAGE						NODE=M071R44 NODE=M071R44
1.251 ± 0.022 ± 0.062		56k	ABLIKIM	17X BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta,$ $\gamma \pi^0 \pi^0 \eta$	
1.26 ± 0.03 ± 0.08		2226	¹ ABLIKIM	10F BES3	$\psi(2S) \rightarrow 3\gamma \pi^+ \pi^-,$ $2\gamma \pi^+ \pi^-$	
1.19 ± 0.08 ± 0.03			PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$	
1.24 ± 0.27 ± 0.15		23	ABLIKIM	06R BES2	$e^+ e^- \rightarrow \psi(2S)$	
1.54 ± 0.31 ± 0.20		~ 43	BAI	98F BES	$\psi(2S) \rightarrow \pi^+ \pi^- 2\gamma,$ $\pi^+ \pi^- 3\gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 60	90	² BRAUNSCH...	77 DASP	$e^+ e^-$
< 11	90	³ BARTEL	76 CNTR	$e^+ e^-$

¹ Combining the results from $\eta' \rightarrow \pi^+ \pi^- \eta$ and $\eta' \rightarrow \pi^+ \pi^- \gamma$ decay modes.

² Restated by us using total decay width 228 keV.

³ The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$.

NODE=M071R44;LINKAGE=AB
NODE=M071R;LINKAGE=R
NODE=M071R;LINKAGE=C

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$			Γ_{190}/Γ			
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
2.73^{+0.29}_{-0.25} OUR AVERAGE					Error includes scale factor of 1.8.	
2.84 ± 0.15 ^{+0.03} _{-0.10}	1.9k	^{1,2} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi \pi$		
2.12 ± 0.19 ± 0.32		^{3,4} BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi \pi$		

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.08 ± 0.19 ± 0.33	200.6 ± 18.8	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$	OCCUR=2
2.90 ± 1.08 ± 1.07	29.9 ± 11.1	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$	OCCUR=3

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (2.39 \pm 0.09 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

⁴ Combining the results from $\pi^+ \pi^-$ and $\pi^0 \pi^0$ decay modes.

NODE=M071R84;LINKAGE=A
NODE=M071R84;LINKAGE=B

NODE=M071R;LINKAGE=3B
NODE=M071R;LINKAGE=B9

$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$			Γ_{191}/Γ			
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
3.1 ± 1.0 ± 1.4	175	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma K \bar{K}$		NODE=M071S75 NODE=M071S75

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S75;LINKAGE=A

$\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$			Γ_{192}/Γ			
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
9.3 ± 1.8 ± 0.6	274	^{1,2} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi \pi$		NODE=M071S76 NODE=M071S76

¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_0(1500))/\Gamma_{\text{total}}] \times [B(f_0(1500) \rightarrow \pi\pi)] = (3.2 \pm 0.6 \pm 0.2) \times 10^{-5}$ which we divide by our best value $B(f_0(1500) \rightarrow \pi\pi) = (34.5 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S76;LINKAGE=A

NODE=M071S76;LINKAGE=B

$\Gamma(\gamma f_2'(1525))/\Gamma_{\text{total}}$			Γ_{193}/Γ			
VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT		
3.3 ± 0.8 ± 0.1	136	^{1,2} DOBBS	15	$\psi(2S) \rightarrow \gamma K \bar{K}$		NODE=M071S77 NODE=M071S77

¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_2'(1525))/\Gamma_{\text{total}}] \times [B(f_2'(1525) \rightarrow K \bar{K})] = (2.9 \pm 0.6 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(f_2'(1525) \rightarrow K \bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S77;LINKAGE=A

NODE=M071S77;LINKAGE=B

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{195} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ± 0.6 OUR AVERAGE				
3.6 ± 0.4 ± 0.5	290	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma \pi \pi$
3.01 ± 0.41 ± 1.24	35.6 ± 4.8	² BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R85
NODE=M071R85

NODE=M071R85;LINKAGE=A
NODE=M071R85;LINKAGE=3B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{196} / Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.6 ± 0.7 OUR AVERAGE					
6.7 ± 0.6 ± 0.6		375	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma K \bar{K}$
6.04 ± 0.90 ± 1.32	39.6 ± 5.9		^{2,3} BAI	03C BES	$\psi(2S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 15.6	90	6.8 ± 3.1	^{2,3} BAI	03C BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
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¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Includes unknown branching fractions to $K^+ K^-$ or $K_S^0 K_S^0$. We have multiplied the $K^+ K^-$ result by a factor of 2 and the $K_S^0 K_S^0$ result by a factor of 4 to obtain the $K \bar{K}$ result.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R86
NODE=M071R86

OCCUR=2

NODE=M071R86;LINKAGE=A

NODE=M071R;LINKAGE=CK

NODE=M071R86;LINKAGE=3B

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{197} / Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
4.8 ± 0.5 ± 0.9	373	¹ DOBBS	15 $\psi(2S) \rightarrow \gamma \pi \pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S78
NODE=M071S78

NODE=M071S78;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{198} / Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
3.2 ± 0.6 ± 0.8	207	¹ DOBBS	15 $\psi(2S) \rightarrow \gamma K \bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S79
NODE=M071S79

NODE=M071S79;LINKAGE=A

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{199} / Γ

VALUE	CL%	DOCUMENT ID	COMMENT
< 5.8 × 10⁻⁶	90	^{1,2} DOBBS	15 $\psi(2S) \rightarrow \gamma \pi \pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+ \pi^-$ and $\pi^0 \pi^0$ are $3.2/4.3 \times 10^{-6}$ and $2.6/4.0 \times 10^{-6}$, respectively.

NODE=M071S80
NODE=M071S80

NODE=M071S80;LINKAGE=A

NODE=M071S80;LINKAGE=DO

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{200} / Γ

VALUE	CL%	DOCUMENT ID	COMMENT
< 9.5 × 10⁻⁶	90	^{1,2} DOBBS	15 $\psi(2S) \rightarrow \gamma K \bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $K^+ K^-$ and $K_S^0 K_S^0$ are $2.1/4.3 \times 10^{-6}$ and $3.7/5.5 \times 10^{-6}$, respectively.

NODE=M071S81
NODE=M071S81

NODE=M071S81;LINKAGE=A

NODE=M071S81;LINKAGE=DO

 $\Gamma(\gamma \eta) / \Gamma_{\text{total}}$ Γ_{201} / Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.92 ± 0.18 OUR AVERAGE					
0.85 ± 0.18 ± 0.04		382	¹ ABLIKIM	17X BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$
1.38 ± 0.48 ± 0.09		13	¹ ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2	90	PEDLAR	09	CLE3	$\psi(2S) \rightarrow \gamma X$
< 90	90	BAI	98F	BES	$\psi(2S) \rightarrow \pi^+ \pi^- 3\gamma$
< 200	90	YAMADA	77	DASP	$e^+ e^- \rightarrow 3\gamma$

¹ Combining the results from $\eta \rightarrow \pi^+ \pi^- \pi^0$ and $\eta \rightarrow 3\pi^0$ decay modes.

NODE=M071R43
NODE=M071R43

NODE=M071R43;LINKAGE=AB

 $\Gamma(\gamma \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{202} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.71 ± 1.25 ± 1.64	418	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R04
NODE=M071R04

$\Gamma(\gamma\eta(1405) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$ Γ_{204} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^- + \text{c.c.}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.3	90	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$
<1.2	90	¹ SCHARRE 80	MRK1	$e^+ e^-$

NODE=M071R61
 NODE=M071R61

OCCUR=2

¹ Includes unknown branching fraction $\eta(1405) \rightarrow K \bar{K} \pi$.

NODE=M071R;LINKAGE=E

 $\Gamma(\gamma\eta(1405) \rightarrow \gamma\eta\pi^+\pi^-) / \Gamma_{\text{total}}$ Γ_{205} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.25 ± 0.05	10	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M071R05
 NODE=M071R05

 $\Gamma(\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0) / \Gamma_{\text{total}}$ Γ_{206} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.0 × 10 ⁻⁷	90	ABLIKIM 17AJ	BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M071P09
 NODE=M071P09

 $\Gamma(\gamma\eta(1475) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$ Γ_{208} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.5	90	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M071R06
 NODE=M071R06

OCCUR=2

 $\Gamma(\gamma\eta(1475) \rightarrow \gamma\eta\pi^+\pi^-) / \Gamma_{\text{total}}$ Γ_{209} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M071R07
 NODE=M071R07

 $\Gamma(\gamma K^{*0} K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{210} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
37.0 ± 6.1 ± 7.2	237	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S29
 NODE=M071S29

 $\Gamma(\gamma K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}}$ Γ_{211} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
24.0 ± 4.5 ± 5.0	41	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S30
 NODE=M071S30

 $\Gamma(\gamma K_S^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{212} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
25.6 ± 3.6 ± 3.6	115	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S31
 NODE=M071S31

 $\Gamma(\gamma K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{213} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
19.1 ± 2.7 ± 4.3	132	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S32
 NODE=M071S32

 $\Gamma(\gamma K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_{214} / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<22	90	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S35
 NODE=M071S35

 $\Gamma(\gamma 2(K^+ K^-)) / \Gamma_{\text{total}}$ Γ_{215} / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S37
 NODE=M071S37

 $\Gamma(\gamma p \bar{p}) / \Gamma_{\text{total}}$ Γ_{216} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9 ± 0.5 OUR AVERAGE				Error includes scale factor of 2.0.
4.18 ± 0.26 ± 0.18	348	¹ ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
2.9 ± 0.4 ± 0.4	142	ABLIKIM 07D	BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S33
 NODE=M071S33

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S33;LINKAGE=AL

$\Gamma(\gamma f_2(1950) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{217}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.2±0.1	111	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S46
NODE=M071S46

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S46;LINKAGE=AL

 $\Gamma(\gamma f_2(2150) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{218}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.72±0.18±0.03	73	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S47
NODE=M071S47

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S47;LINKAGE=AL

 $\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{219}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
4.57±0.36^{+1.77}_{-4.26}		ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p \bar{p}$

NODE=M071S48
NODE=M071S48

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.6	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
<5.4	90	ABLIKIM	07D BES	$\psi(2S) \rightarrow \gamma p \bar{p}$

 $\Gamma(\gamma X \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{220}/Γ

For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S49
NODE=M071S49
NODE=M071S49 $\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{221}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.8±1.2±0.7	17	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S34
NODE=M071S34 $\Gamma(\gamma \gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{223}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±0.6^{+0.8}_{-1.0}	1.1k	ABLIKIM	120 BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S55
NODE=M071S55

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.2±0.6	1.1k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$
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¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$. No systematic error estimation.

NODE=M071S55;LINKAGE=A

 $\Gamma(e^+ e^- \eta')/\Gamma_{\text{total}}$ Γ_{224}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.90±0.26 OUR AVERAGE				
1.99±0.33±0.12	57	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$, $\eta' \rightarrow \gamma \pi^+ \pi^-$
1.79±0.38±0.11	20	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$, $\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M071P12
NODE=M071P12

OCCUR=2

 $\Gamma(e^+ e^- \eta_c(1S))/\Gamma_{\text{total}}$ Γ_{225}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.77±0.40±0.18	3k	¹ ABLIKIM	22AX BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071P44
NODE=M071P44

¹ From a fit to the recoil mass distribution of $e^+ e^-$ with inclusive $\eta_c(1S)$ decays.

NODE=M071P44;LINKAGE=A

 $\Gamma(e^+ e^- \chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{226}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.5±2.5 OUR AVERAGE				[(10.6 ± 2.5) × 10 ⁻⁴ OUR 2024 AVERAGE]
10.5±2.4±0.7	48	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

NODE=M071P01
NODE=M071P01

NEW

¹ ABLIKIM 17I reports $(11.7 \pm 2.5 \pm 1.0) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+ e^- \chi_{c0}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (1.27 \pm 0.06) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (1.41 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P01;LINKAGE=B

$\Gamma(e^+e^-\chi_{c0}(1P))/\Gamma(\gamma\chi_{c0}(1P))$ $\Gamma_{226}/\Gamma_{181}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.4 \pm 1.9 \pm 0.6$	48	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P04
NODE=M071P04

¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) \times B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (15.8 \pm 0.3 \pm 0.6) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P04;LINKAGE=A

 $\Gamma(e^+e^-\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{227}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.5 \pm 0.6 \pm 0.3$	873	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P02
NODE=M071P02

¹ ABLIKIM 17I reports $(8.6 \pm 0.3 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^-\chi_{c1}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (33.9 \pm 1.2) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (34.3 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P02;LINKAGE=B

 $\Gamma(e^+e^-\chi_{c1}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{227}/\Gamma_{182}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.3 \pm 0.3 \pm 0.4$	873	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P05
NODE=M071P05

¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (351.8 \pm 1.0 \pm 12.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P05;LINKAGE=A

 $\Gamma(e^+e^-\chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{228}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.8 \pm 0.7 \pm 0.3$	227	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P03
NODE=M071P03

¹ ABLIKIM 17I reports $(6.9 \pm 0.5 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^-\chi_{c2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.2 \pm 0.7) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.5 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P03;LINKAGE=B

 $\Gamma(e^+e^-\chi_{c2}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{228}/\Gamma_{183}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.6 \pm 0.5 \pm 0.4$	227	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P06
NODE=M071P06

¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) \times B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (199.6 \pm 0.8 \pm 7.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P06;LINKAGE=A

WEAK DECAYS

NODE=M071330

 $\Gamma(D^0e^+e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{229}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4 \times 10^{-7}$	90	¹ ABLIKIM	17AF BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P07
NODE=M071P07

¹ Using D^0 decays to $K^-\pi^+$, $K^-\pi^+\pi^0$, and $K^-\pi^+\pi^+\pi^-$.

NODE=M071P07;LINKAGE=A

 $\Gamma(\Lambda_c^+\bar{\Sigma}^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{230}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4 \times 10^{-5}$	90	¹ ABLIKIM	23 BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P43
NODE=M071P43

¹ Using $\Lambda_c^+ \rightarrow pK^-\pi^+$ and $\bar{\Sigma}^- \rightarrow \bar{p}\pi^0$.

NODE=M071P43;LINKAGE=A

OTHER DECAYS

NODE=M071320

 $\Gamma(\text{invisible})/\Gamma(e^+e^-)$ Γ_{231}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.0	90	LEES	13I BABR	$B \rightarrow K^{(*)}\psi(2S)$

NODE=M071S64
NODE=M071S64 $\psi(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M071240

For measurements involving $B(\psi(2S) \rightarrow \gamma\eta_c(2S)) \times B(\eta_c(2S) \rightarrow X)$ see the corresponding entries in the $\eta_c(2S)$ sections.

NODE=M071240

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$$\psi(2S) \rightarrow \gamma \chi_{cJ}(1P) \text{ and } \chi_{cJ} \rightarrow \gamma J/\psi(1S)$$

NODE=M071250

 $a_2(\chi_{c1})/a_2(\chi_{c2})$ Magnetic quadrupole transition amplitude ratioNODE=M071QAR
NODE=M071QAR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
63 ± 7 OUR AVERAGE				
61.7 ± 8.3	253k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
67 ⁺¹⁹ ₋₁₃	59k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined.² Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $a_2(\chi_{c1}(1P))$ and $a_2(\chi_{c2}(1P))$ from ARTUSO 09.NODE=M071QAR;LINKAGE=A
NODE=M071QAR;LINKAGE=AR $b_2(\chi_{c2})/b_2(\chi_{c1})$ Magnetic quadrupole transition amplitude ratioNODE=M071QBR
NODE=M071QBR

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
60 ± 31 OUR AVERAGE				
74 ± 40	253k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
37 ⁺⁵³ ₋₄₇	59k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Derived from the reported measurement of $b_2(\chi_{c1})/b_2(\chi_{c2}) = 1.35 \pm 0.72$.² Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $b_2(\chi_{c1}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M071QBR;LINKAGE=A

NODE=M071QBR;LINKAGE=AR

 $\psi(2S)$ REFERENCES

NODE=M071

ABLIKIM	24AG	JHEP 2404 013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62687
ABLIKIM	24BS	PR D110 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63022
ABLIKIM	24J	PR D109 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62660
ABLIKIM	24N	PR D109 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62664
ABLIKIM	24O	PR D109 072015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62666
AAIJ	23AP	JHEP 2307 084	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62412
ABLIKIM	23	CP C47 013002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61897
ABLIKIM	23BA	PR D108 052001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62421
ABLIKIM	23BE	PR D108 092011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62427
ABLIKIM	23BV	PR D108 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62518
LEES	23	PR D107 072001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=62061
LIAO	23	PR D107 112007	L. Liao <i>et al.</i>		REFID=62279
ABLIKIM	22AP	PR D106 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61888
ABLIKIM	22AQ	PR D106 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61889
ABLIKIM	22AV	JHEP 2212 016	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61899
ABLIKIM	22AX	PR D106 112002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61901
ABLIKIM	22AY	PR D106 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61902
ABLIKIM	22AZ	PR D106 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61903
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AL	PR D104 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61444
ABLIKIM	21AO	PR D104 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61447
ABLIKIM	21AT	JHEP 2111 226	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61463
ABLIKIM	21E	PRL 126 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61033
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	21S	PL B820 136576	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61152
ABLIKIM	21Z	PRL 127 082002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61265
LEES	21	PR D103 092001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61113
LEES	21C	PR D104 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61451
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AO	PR D99 112010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59892
ABLIKIM	19AT	PR D100 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59989
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
ABLIKIM	19I	PR D99 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59605
ABLIKIM	19N	PR D99 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59615
ABLIKIM	18Q	PR D97 091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58933
ABLIKIM	18T	PR D98 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58975
ABLIKIM	18Z	PL B783 452	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59038
ANASHIN	18	PL B781 174	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=59013
LEES	18E	PR D98 112015	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=59505
ABLIKIM	17AF	PR D96 111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58315
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58322
ABLIKIM	17AK	PR D96 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58324
ABLIKIM	17E	PL B770 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57903
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17L	PR D95 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57967
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
ABLIKIM	17X	PR D96 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58216
DOBBS	17	PR D96 092004	S. Dobbs <i>et al.</i>	(NWES, WAYN)	REFID=58670
LEES	17A	PR D95 052001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57966
AAIJ	16Y	JHEP 1605 132	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57333
ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57510
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56787
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988

ABLIKIM	14G	PR D89 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55898
DOBBS	14	PL B739 90	S. Dobbs <i>et al.</i>	(NWES, WAYN)	REFID=56333
ABLIKIM	13A	PRL 110 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54834
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54920
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55386
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55402
ABLIKIM	13S	PR D88 032010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55403
ABLIKIM	13W	PR D88 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55634
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54269
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54272
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54273
ABLIKIM	12L	PR D86 072011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54739
ABLIKIM	12M	PR D86 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54740
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
ABLIKIM	12Q	CP C36 1040	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=54864
ANASHIN	12	PL B711 280	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54038
LEES	12E	PR D85 112009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54297
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
ABLIKIM	10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53348
ABLIKIM	10F	PRL 105 261801	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53630
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=53233
ADAMS	09	PR D80 051106	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=53103
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
LIBBY	09	PR D80 072002	J. Libby <i>et al.</i>	(CLEO Collab.)	REFID=53124
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08C	PL B659 789	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52130
DOBBS	08A	PRL 101 182003	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52579
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ABLIKIM	07C	PL B648 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51636
ABLIKIM	07D	PRL 99 011802	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51725
ABLIKIM	07H	PR D76 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52046
ANASHIN	07	JETPL 85 347	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=51655
ANDREOTTI	07	Translated from ZETFP 85 429	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (errata.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
PDG	07	Unofficial 2007 WWW edition		(PDG Collab.)	REFID=52717; ERROR=8
PEDLAR	07	PR D75 011102	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=51630
ABLIKIM	06G	PR D73 052004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51048
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06W	PR D74 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51560
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT_BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
DOBBS	06A	PR D74 011105	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=51158
ABLIKIM	05E	PR D71 072006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50757
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05I	PL B614 37	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50758
ABLIKIM	05J	PL B619 247	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50760
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05	PRL 94 012005	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50451
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05	PR D71 032006	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50497
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
BRIERE	05	PRL 95 062001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50785
PEDLAR	05	PR D72 051108	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=50808
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=50812
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04K	PR D70 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50327
ABLIKIM	04L	PR D70 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50328
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04B	PRL 92 052001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49608
BAI	04C	PR D69 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49749
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03B	PR D67 052002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49186
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
AUBERT	02B	PR D65 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48548
BAI	02	PR D65 052004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48578
BAI	02B	PL B550 24	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49171
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
PDG	02	PR D66 010001	K. Hagiwara <i>et al.</i>	(PDG Collab.)	REFID=48632
BAI	01	PR D63 032002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48003
AMBROGIANI	00A	PR D62 032004	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47939
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
BAI	98F	PR D58 097101	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46340
BAI	98J	PRL 81 5080	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46554
ARMSTRONG	97	PR D55 1153	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45416
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 and E706 Collab.)	REFID=44739
ARMSTRONG	93B	NP D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
KURAEV	85	JJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					

FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)
OREGLIA	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)
BRANDELIC	79B	NP B160 426	Translated from YAF 34 1471. R. Brandelik <i>et al.</i>	(DASP Collab.)
BRANDELIC	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)
BRAUNSCH...	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)
ABRAMS	75	Stanford Symp. 25	G.S. Abrams	(LBL)
ABRAMS	75B	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)
BOYARSKI	75C	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)
HILGER	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)
LIBERMAN	75	Stanford Symp. 55	A.D. Liberman	(STAN)
LUTH	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC
WIJK	75	Stanford Symp. 69	B.H. Wiik	(DESY)

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$\psi(3770)$

$$I^G(J^{PC}) = 0^-(1^--)$$

NODE=M053

$\psi(3770)$ MASS (MeV)

NODE=M053M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M053M

3773.7±0.7 OUR FIT Error includes scale factor of 2.3.

3778.1±0.7 OUR AVERAGE

3778.1±0.7±0.6		¹ AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
3779.2 ^{+1.8+0.6} _{-1.7-0.8}		² ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
3775.5±2.4±0.5	57	AUBERT	08B BABR	$B \rightarrow D\bar{D}K$
3776 ±5 ±4	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0K^+$
3778.8±1.9±0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3778.8±0.3		³ HANHART	24 RVUE	K-matrix formalism
3779.8±0.6		⁴ SHAMOV	17 RVUE	$e^+e^- \rightarrow D\bar{D}$, hadrons
3772.0±1.9		^{5,6} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
3778.4±3.0±1.3	34	CHISTOV	04 BELL	Sup. by BRODZICKA 08

NODE=M053M;LINKAGE=B
NODE=M053M;LINKAGE=AN
NODE=M053M;LINKAGE=C

- ¹ Measured in prompt hadroproduction.
- ² Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.
- ³ Real part of pole location extracted using K-matrix formalism that includes two resonance poles, $\psi(2S)$ and $\psi(3770)$.
- ⁴ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.
- ⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.
- ⁶ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

NODE=M053M;LINKAGE=A
NODE=M053M;LINKAGE=AB

NODE=M053M;LINKAGE=NI

$m_{\psi(3770)} - m_{\psi(2S)}$

NODE=M053DM

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M053DM

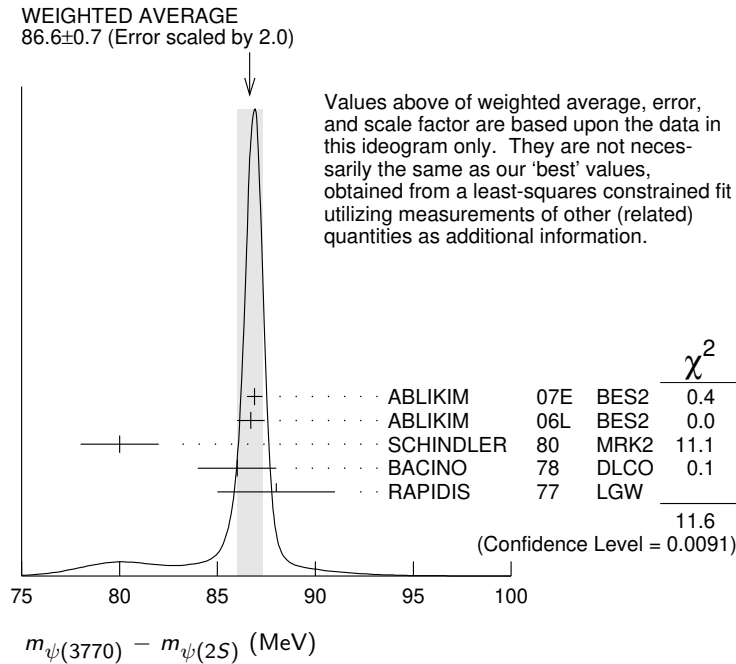
87.6±0.7 OUR FIT Error includes scale factor of 2.3.

86.6±0.7 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.

86.9±0.4	¹ ABLIKIM	07E BES2	$e^+e^- \rightarrow \text{hadrons}$
86.7±0.7	ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
80 ±2	SCHINDLER	80 MRK2	e^+e^-
86 ±2	² BACINO	78 DLCO	e^+e^-
88 ±3	RAPIDIS	77 LGW	e^+e^-

- ¹ BES-II $\psi(2S)$ mass subtracted (see ABLIKIM 06L).
- ² SPEAR $\psi(2S)$ mass subtracted (see SCHINDLER 80).

NODE=M053DM;LINKAGE=AK
 NODE=M053DM;LINKAGE=S



$\psi(3770)$ WIDTH

NODE=M053W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.2 ± 1.0 OUR FIT				
27.5 ± 0.9 OUR AVERAGE				
24.9 ⁺ ₋ 4.6 ⁺ ₋ 4.0 ⁻ ₋ 1.1		1 ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
30.4 ± 8.5		2,3 ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
27 ± 10 ± 5	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0 K^+$
28.5 ± 1.2 ± 0.2		3 ABLIKIM	07E BES2	$e^+e^- \rightarrow$ hadrons
23.5 ± 3.7 ± 0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
26.9 ± 2.4 ± 0.3		3 ABLIKIM	06L BES2	$e^+e^- \rightarrow$ hadrons
24 ± 5		3 SCHINDLER	80 MRK2	e^+e^-
24 ± 5		3 BACINO	78 DLCO	e^+e^-
28 ± 5		3 RAPIDIS	77 LGW	e^+e^-
••• We do not use the following data for averages, fits, limits, etc. •••				
25.0 ± 0.5		4 HANHART	24 RVUE	K-matrix formalism
25.8 ± 1.3		5 SHAMOV	17 RVUE	$e^+e^- \rightarrow D\bar{D}$, hadrons

NODE=M053W

- ¹ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.
- ² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.
- ³ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.
- ⁴ $-2 \times$ imaginary part of pole location extracted using K-matrix formalism that includes two resonance poles, $\psi(2S)$ and $\psi(3770)$.
- ⁵ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.

NODE=M053W;LINKAGE=AN
 NODE=M053W;LINKAGE=AB

NODE=M053W;LINKAGE=NI

NODE=M053W;LINKAGE=B

NODE=M053W;LINKAGE=A

$\psi(3770)$ DECAY MODES

NODE=M053220;NODE=M053

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D\bar{D}$	(93 ⁺⁸ ₋₉) %	S=2.0
Γ_2 $D^0\bar{D}^0$	(52 ⁺⁴ ₋₅) %	S=2.0
Γ_3 D^+D^-	(41 ± 4) %	S=2.0
Γ_4 $J/\psi X$	(5.0 ± 2.2) × 10 ⁻³	

DESIG=2

DESIG=5

DESIG=6

DESIG=235

Γ ₅	$J/\psi \pi^+ \pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		DESIG=4
Γ ₆	$J/\psi \pi^0 \pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		DESIG=46
Γ ₇	$J/\psi \eta$	$(8.7 \pm 1.2) \times 10^{-4}$		DESIG=47
Γ ₈	$J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=48
Γ ₉	$e^+ e^-$	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	DESIG=1

Decays to light hadrons

Γ ₁₀	$b_1(1235) \pi$	$< 1.4 \times 10^{-5}$	CL=90%	NODE=M053;CLUMP=H DESIG=20
Γ ₁₁	$\phi \eta'$	$< 2.3 \times 10^{-5}$	CL=90%	DESIG=17
Γ ₁₂	$\omega \eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=16
Γ ₁₃	$\rho^0 \eta'$	$< 6 \times 10^{-4}$	CL=90%	DESIG=15
Γ ₁₄	$\phi \eta$	$(3.1 \pm 0.7) \times 10^{-4}$		DESIG=8
Γ ₁₅	$\omega \eta$	$< 1.4 \times 10^{-5}$	CL=90%	DESIG=14
Γ ₁₆	$\rho^0 \eta$	$< 5 \times 10^{-4}$	CL=90%	DESIG=13
Γ ₁₇	$\phi \pi^0$	$< 3 \times 10^{-5}$	CL=90%	DESIG=12
Γ ₁₈	$\omega \pi^0$	$< 6 \times 10^{-4}$	CL=90%	DESIG=11
Γ ₁₉	$\pi^+ \pi^- \pi^0$	$< 5 \times 10^{-6}$	CL=90%	DESIG=9
Γ ₂₀	$\rho \pi$	$< 5 \times 10^{-6}$	CL=90%	DESIG=10
Γ ₂₁	$K^+ K^-$	not seen		DESIG=234;OUR EST;→ UNCHECKED ←
Γ ₂₂	$K^*(892)^+ K^- + c.c.$	$< 1.4 \times 10^{-5}$	CL=90%	DESIG=19
Γ ₂₃	$K^*(892)^0 \bar{K}^0 + c.c.$	$< 1.2 \times 10^{-3}$	CL=90%	DESIG=18
Γ ₂₄	$K_S^0 K_L^0$	$(2.6^{+1.4}_{-1.6}) \times 10^{-5}$		DESIG=3
Γ ₂₅	$2(\pi^+ \pi^-)$	$< 1.12 \times 10^{-3}$	CL=90%	DESIG=21
Γ ₂₆	$2(\pi^+ \pi^-) \pi^0$	$< 1.06 \times 10^{-3}$	CL=90%	DESIG=22
Γ ₂₇	$2(\pi^+ \pi^- \pi^0)$	$< 5.85 \%$	CL=90%	DESIG=208
Γ ₂₈	$\omega \pi^+ \pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	DESIG=24
Γ ₂₉	$3(\pi^+ \pi^-)$	$< 9.1 \times 10^{-3}$	CL=90%	DESIG=52
Γ ₃₀	$3(\pi^+ \pi^-) \pi^0$	$< 1.37 \%$	CL=90%	DESIG=55
Γ ₃₁	$3(\pi^+ \pi^-) 2\pi^0$	$< 11.74 \%$	CL=90%	DESIG=210
Γ ₃₂	$\eta \pi^+ \pi^-$	$< 1.24 \times 10^{-3}$	CL=90%	DESIG=23
Γ ₃₃	$\pi^+ \pi^- 2\pi^0$	$< 8.9 \times 10^{-3}$	CL=90%	DESIG=206
Γ ₃₄	$\rho^0 \pi^+ \pi^-$	$< 6.9 \times 10^{-3}$	CL=90%	DESIG=64
Γ ₃₅	$\eta 3\pi$	$< 1.34 \times 10^{-3}$	CL=90%	DESIG=25
Γ ₃₆	$\eta 2(\pi^+ \pi^-)$	$< 2.43 \%$	CL=90%	DESIG=53
Γ ₃₇	$\eta \rho^0 \pi^+ \pi^-$	$< 1.45 \%$	CL=90%	DESIG=221
Γ ₃₈	$\eta' 3\pi$	$< 2.44 \times 10^{-3}$	CL=90%	DESIG=26
Γ ₃₉	$K^+ K^- \pi^+ \pi^-$	$< 9.0 \times 10^{-4}$	CL=90%	DESIG=27
Γ ₄₀	$\phi \pi^+ \pi^-$	$< 4.1 \times 10^{-4}$	CL=90%	DESIG=28
Γ ₄₁	$K^+ K^- 2\pi^0$	$< 4.2 \times 10^{-3}$	CL=90%	DESIG=207
Γ ₄₂	$4(\pi^+ \pi^-)$	$< 1.67 \%$	CL=90%	DESIG=62
Γ ₄₃	$4(\pi^+ \pi^-) \pi^0$	$< 3.06 \%$	CL=90%	DESIG=63
Γ ₄₄	$\phi f_0(980)$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=29
Γ ₄₅	$K^+ K^- \pi^+ \pi^- \pi^0$	$< 2.36 \times 10^{-3}$	CL=90%	DESIG=30
Γ ₄₆	$K^+ K^- \rho^0 \pi^0$	$< 8 \times 10^{-4}$	CL=90%	DESIG=67
Γ ₄₇	$K^+ K^- \rho^+ \pi^-$	$< 1.46 \%$	CL=90%	DESIG=68
Γ ₄₈	$\omega K^+ K^-$	$< 3.4 \times 10^{-4}$	CL=90%	DESIG=32
Γ ₄₉	$\phi \pi^+ \pi^- \pi^0$	$< 3.8 \times 10^{-3}$	CL=90%	DESIG=69
Γ ₅₀	$K^{*0} K^- \pi^+ \pi^0 + c.c.$	$< 1.62 \%$	CL=90%	DESIG=70
Γ ₅₁	$K^{*+} K^- \pi^+ \pi^- + c.c.$	$< 3.23 \%$	CL=90%	DESIG=71
Γ ₅₂	$K^+ K^- \pi^+ \pi^- 2\pi^0$	$< 2.67 \%$	CL=90%	DESIG=209
Γ ₅₃	$K^+ K^- 2(\pi^+ \pi^-)$	$< 1.03 \%$	CL=90%	DESIG=57
Γ ₅₄	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$< 3.60 \%$	CL=90%	DESIG=58
Γ ₅₅	$\eta K^+ K^-$	$< 4.1 \times 10^{-4}$	CL=90%	DESIG=31
Γ ₅₆	$\eta K^+ K^- \pi^+ \pi^-$	$< 1.24 \%$	CL=90%	DESIG=222
Γ ₅₇	$\rho^0 K^+ K^-$	$< 5.0 \times 10^{-3}$	CL=90%	DESIG=65
Γ ₅₈	$2(K^+ K^-)$	$< 6.0 \times 10^{-4}$	CL=90%	DESIG=33
Γ ₅₉	$\phi K^+ K^-$	$< 7.5 \times 10^{-4}$	CL=90%	DESIG=34
Γ ₆₀	$2(K^+ K^-) \pi^0$	$< 2.9 \times 10^{-4}$	CL=90%	DESIG=35

Г61	$2(K^+K^-)\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
Г62	$K_S^0 K^- \pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
Г63	$K_S^0 K^- \pi^+ \pi^0$	< 1.33	%	CL=90%	DESIG=201
Г64	$K_S^0 K^- \rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
Г65	$K_S^0 K^- 2\pi^+ \pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
Г66	$K_S^0 K^- \pi^+ \rho^0$	< 1.6	%	CL=90%	DESIG=215
Г67	$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	DESIG=216
Г68	$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	DESIG=203
Г69	$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	DESIG=217
Г70	$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	DESIG=204
Г71	$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	DESIG=205
Г72	$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
Г73	$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	DESIG=219
Г74	$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	DESIG=220
Г75	$K^{*0} K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
Г76	$p\bar{p}$	not seen			DESIG=233;OUR EST;→ UNCHECKED ←
Г77	$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=54
Г78	$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
Г79	$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
Г80	$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
Г81	$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
Г82	$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	DESIG=72
Г83	$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
Г84	$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
Г85	$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
Г86	$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
Г87	$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
Г88	$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224
Г89	$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Г90	$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Г91	$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Г92	$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Г93	$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45
Г94	$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	DESIG=226
Г95	$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=227
Г96	$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=228
Г97	$\Xi^0 \bar{\Xi}^0$	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=230
Г98	$\Xi^- \bar{\Xi}^+$	(1.4 ± 0.4)	$\times 10^{-4}$		DESIG=236
Г99	$\Lambda\bar{\Xi}^+ K^- + \text{c.c.}$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=237
Г100	$\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=238

Radiative decays

Г101	$\gamma\chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	DESIG=51
Г102	$\gamma\chi_{c1}$	(2.49 ± 0.23)	$\times 10^{-3}$		DESIG=50
Г103	$\gamma\chi_{c0}$	(6.9 ± 0.6)	$\times 10^{-3}$		DESIG=49
Г104	$\gamma\eta_c$	< 7	$\times 10^{-4}$	CL=90%	DESIG=231
Г105	$\gamma\eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	DESIG=232
Г106	$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Г107	$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Г108	$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%	DESIG=211

NODE=M053;CLUMP=R

FIT INFORMATION

An overall fit to the total width, a partial width, and 3 branching ratios uses 23 measurements to determine 4 parameters. The overall fit has a $\chi^2 = 20.1$ for 19 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_3	99		
x_9	0	0	
Γ	0	0	-44
	x_2	x_3	x_9

Mode	Rate (MeV)	Scale factor
Γ_2 $D^0 \bar{D}^0$	14.0 ± 1.4	1.8
Γ_3 $D^+ D^-$	11.2 ± 1.1	1.7
Γ_9 $e^+ e^-$	$(2.62 \pm 0.18) \times 10^{-4}$	1.4

DESIG=5
DESIG=6
DESIG=1

$\psi(3770)$ PARTIAL WIDTHS

NODE=M053225

$\Gamma(e^+ e^-)$

Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.262 ± 0.018 OUR FIT				Error includes scale factor of 1.4.
0.256 ± 0.016 OUR AVERAGE				Error includes scale factor of 1.2.
$0.154^{+0.079+0.021}_{-0.058-0.027}$		1,2 ANASHIN	12A KEDR	$e^+ e^- \rightarrow D \bar{D}$
0.22 ± 0.05		3,4 ABLIKIM	08D BES2	$e^+ e^- \rightarrow$ hadrons
$0.277 \pm 0.011 \pm 0.013$		4 ABLIKIM	07E BES2	$e^+ e^- \rightarrow$ hadrons
$0.203 \pm 0.003^{+0.041}_{-0.027}$	1.4M	4,5 BESSON	06 CLEO	$e^+ e^- \rightarrow$ hadrons
0.276 ± 0.050		4 SCHINDLER	80 MRK2	$e^+ e^-$
0.18 ± 0.06		4 BACINO	78 DLCO	$e^+ e^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.196 ± 0.018		6 SHAMOV	17 RVUE	$e^+ e^- \rightarrow D \bar{D}$, hadrons
$0.414^{+0.072+0.093}_{-0.080-0.028}$		2,7 ANASHIN	12A KEDR	$e^+ e^- \rightarrow D \bar{D}$
0.37 ± 0.09		8 RAPIDIS	77 LGW	$e^+ e^-$

NODE=M053W1
NODE=M053W1

OCCUR=2
OCCUR=2

¹ Solution I of the two solutions.

² Taking into account interference between the resonant and non-resonant $D \bar{D}$ production.

³ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.

⁴ Interference between the resonant and non-resonant $D \bar{D}$ production not taken into account.

⁵ BESSON 06 (as corrected in BESSON 10) measure $\sigma(e^+ e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb at $\sqrt{s} = 3773 \pm 1$ MeV, and obtain Γ_{ee} from the Born-level cross section calculated using $\psi(3770)$ mass and width from our 2004 edition, PDG 04.

⁶ From the joint analysis of the data on the $D \bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.

⁷ Solution II of the two solutions.

⁸ See also $\Gamma(e^+ e^-) / \Gamma_{\text{total}}$ below.

NODE=M053W1;LINKAGE=A1
NODE=M053W1;LINKAGE=AN
NODE=M053W1;LINKAGE=AB

NODE=M053W1;LINKAGE=NI
NODE=M053W1;LINKAGE=BE

NODE=M053W1;LINKAGE=B

NODE=M053W1;LINKAGE=A2
NODE=M053W1;LINKAGE=R

$\psi(3770) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M053235

$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{95} \Gamma_9 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$< 101.5 \times 10^{-3}$	90	1 ABLIKIM	24AH BES3	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

¹ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M053P03
NODE=M053P03

NODE=M053P03;LINKAGE=A

$\Gamma(\Xi^0 \bar{\Xi}^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{97} \Gamma_9 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$< 89.0 \times 10^{-3}$	90	1 ABLIKIM	24CD BES3	$e^+ e^- \rightarrow \psi(3770)$

¹ From a fit to $e^+ e^- \rightarrow \Xi^0 \bar{\Xi}^0$ cross sections.

NODE=M053P06
NODE=M053P06

NODE=M053P06;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{98} \Gamma_9 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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$(3.55 \pm 0.92) \times 10^{-2}$	¹ ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(3770)$
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¹ From a fit to $e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$ cross sections. Signal significance is 4.5σ .

NODE=M053P01
NODE=M053P01

NODE=M053P01;LINKAGE=A

$$\Gamma(\Lambda \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{99} \Gamma_9 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 25.0 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$
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¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M053P04
NODE=M053P04

NODE=M053P04;LINKAGE=A

$$\Gamma(\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{100} \Gamma_9 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 89.5 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$
-------------------------	----	----------------------	-----------	--

¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M053P05
NODE=M053P05

NODE=M053P05;LINKAGE=A

$\psi(3770)$ BRANCHING RATIOS

NODE=M053230

$$\Gamma(D\bar{D}) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma = (\Gamma_2 + \Gamma_3) / \Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.93 $^{+0.08}_{-0.09}$ **OUR FIT** Error includes scale factor of 2.0.

0.93 $^{+0.08}_{-0.09}$ **OUR AVERAGE** Error includes scale factor of 2.1.

$0.849 \pm 0.056 \pm 0.018$	¹ ABLIKIM	08B BES2	$e^+ e^- \rightarrow \text{non-}D\bar{D}$
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$1.033 \pm 0.014^{+0.048}_{-0.066}$	1.427M	² BESSON	06 CLEO $e^+ e^- \rightarrow \text{hadrons}$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.836 ± 0.049	³ SHAMOV	17 RVUE	$e^+ e^- \rightarrow D\bar{D}, \text{hadrons}$
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$0.866 \pm 0.050 \pm 0.036$	^{4,5} ABLIKIM	07K BES2	$e^+ e^- \rightarrow \text{non-}D\bar{D}$
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$0.836 \pm 0.073 \pm 0.042$	⁵ ABLIKIM	06L BES2	$e^+ e^- \rightarrow D\bar{D}$
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$0.855 \pm 0.017 \pm 0.058$	^{5,6} ABLIKIM	06N BES2	$e^+ e^- \rightarrow D\bar{D}$
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¹ Neglecting interference.

² Obtained by comparing a measurement of the total cross section (corrected in BESSON 10) with that of $D\bar{D}$ reported by CLEO in DOBBS 07.

³ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.

⁴ Using $\sigma^{obs} = 7.07 \pm 0.58$ nb and neglecting interference.

⁵ Not independent of ABLIKIM 08B.

⁶ From a measurement of $\sigma(e^+ e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.

NODE=M053R1
NODE=M053R1

NODE=M053R1;LINKAGE=AI
NODE=M053R1;LINKAGE=BE

NODE=M053R1;LINKAGE=A

NODE=M053R1;LINKAGE=AL
NODE=M053R1;LINKAGE=SU
NODE=M053R1;LINKAGE=AB

$$\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.52 $^{+0.04}_{-0.05}$ **OUR FIT** Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.467 \pm 0.047 \pm 0.023$	ABLIKIM	06L BES2	$e^+ e^- \rightarrow D^0 \bar{D}^0$
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$0.499 \pm 0.013 \pm 0.038$	¹ ABLIKIM	06N BES2	$e^+ e^- \rightarrow D^0 \bar{D}^0$
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¹ From a measurement of $\sigma(e^+ e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.

NODE=M053R46
NODE=M053R46

NODE=M053R46;LINKAGE=AB

$$\Gamma(D^+ D^-) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.41 ± 0.04 **OUR FIT** Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.369 \pm 0.037 \pm 0.028$	ABLIKIM	06L BES2	$e^+ e^- \rightarrow D^+ D^-$
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$0.357 \pm 0.011 \pm 0.034$	¹ ABLIKIM	06N BES2	$e^+ e^- \rightarrow D^+ D^-$
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¹ From a measurement of $\sigma(e^+ e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.

NODE=M053R47
NODE=M053R47

NODE=M053R47;LINKAGE=AB

$\Gamma(D^0\bar{D}^0)/\Gamma(D^+D^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.253±0.016 OUR FIT				
1.253±0.016 OUR AVERAGE				
1.252±0.009±0.013	5.3M	BONVICINI	14	CLEO $e^+e^- \rightarrow D\bar{D}$
1.39 ±0.31 ±0.12		PAKHOLOVA	08	BELL 10.6 $e^+e^- \rightarrow D\bar{D}\gamma$
1.78 ±0.33 ±0.24		AUBERT	07BE	BABR $e^+e^- \rightarrow D\bar{D}\gamma$
1.27 ±0.12 ±0.08		ABLIKIM	06L	BES2 $e^+e^- \rightarrow D\bar{D}$
2.43 ±1.50 ±0.43	34	¹ CHISTOV	04	BELL $B^+ \rightarrow \psi(3770)K^+$
1.258±0.016±0.014		² DOBBS	07	CLEO $e^+e^- \rightarrow D\bar{D}$

¹See ADLER 88C for older measurements of this quantity.

²Superseded by BONVICINI 14.

NODE=M053R5
NODE=M053R5

NODE=M053R5;LINKAGE=CH
NODE=M053R5;LINKAGE=DO

 $\Gamma(J/\psi X)/\Gamma_{\text{total}}$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0.5±0.2±0.1	¹ ABLIKIM	21Z	BES3 $e^+e^- \rightarrow \ell^+\ell^-X$

¹From a fit to the $e^+e^- \rightarrow J/\psi X$ cross section between 3.645 and 3.891 GeV, with $\psi(2S)$ and $\psi(3770)$ masses, total widths and leptonic widths fixed to the values from the PDG 20. An alternative fit with an improved χ^2 , corresponding to a significance of 5.3 σ , uses an additional resonance with a mass of $3766.2 \pm 3.8 \pm 0.4$ MeV/ c^2 , a total width of $22.2 \pm 5.9 \pm 1.4$ MeV, and $\Gamma(e^+e^-B(J/\psi X)) = 79.4 \pm 85.5 \pm 11.7$ eV, possibly compatible with the results of ABLIKIM 08H.

NODE=M053P00
NODE=M053P00

NODE=M053P00;LINKAGE=A

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.93±0.28 OUR AVERAGE				
1.89±0.20±0.20	231 ± 33	ADAM	06	CLEO $e^+e^- \rightarrow \psi(3770)$
3.4 ±1.4 ±0.9	17.8 ± 4.8	BAI	05	BES2 $e^+e^- \rightarrow \psi(3770)$

NODE=M053R4
NODE=M053R4

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.080±0.025±0.016	39 ± 14	ADAM	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R7
NODE=M053R7

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.7±1.2 OUR AVERAGE				
8.7±1.0±0.8	232 ± 23	¹ ABLIKIM	23V	BES3 $e^+e^- \rightarrow \psi(3770)$
8.7±3.3±2.2	22 ± 10	ADAM	06	CLEO $e^+e^- \rightarrow \psi(3770)$

¹Incoherent fit. Alternate fits that include interference with background yield results between $(11.2 \pm 5.8 \pm 1.1) \times 10^{-4}$ and $(11.6 \pm 6.0 \pm 1.1) \times 10^{-4}$.

NODE=M053R8
NODE=M053R8

NODE=M053R8;LINKAGE=A

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<28	90	<10	ADAM	06	CLEO $e^+e^- \rightarrow \psi(3770)$

NODE=M053R9
NODE=M053R9

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
0.96±0.07 OUR FIT			Error includes scale factor of 1.3.
1.3 ±0.2	RAPIDIS	77	LGW e^+e^-

NODE=M053R2
NODE=M053R2

————— DECAYS TO LIGHT HADRONS —————

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

¹Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053250

NODE=M053R82
NODE=M053R82

NODE=M053R82;LINKAGE=AD

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.3 × 10⁻⁵	90	¹ ABLIKIM	23BC	BES3 $e^+e^- \rightarrow \psi(3770)$
<7 × 10⁻⁴	90	² ADAMS	06	CLEO $e^+e^- \rightarrow \psi(3770)$

¹ABLIKIM 23BC fit to $e^+e^- \rightarrow \phi\eta'$ cross sections between 3.508 and 4.951 GeV considering interference between continuum and $\psi(3770)$ amplitudes.

²ADAMS 06 compare cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R83
NODE=M053R83

NODE=M053R83;LINKAGE=A

NODE=M053R83;LINKAGE=AD

$\Gamma(\omega\eta')/\Gamma_{\text{total}}$					Γ_{12}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<4	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R84 NODE=M053R84
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R84;LINKAGE=AD
$\Gamma(\rho^0\eta')/\Gamma_{\text{total}}$					Γ_{13}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<6	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R85 NODE=M053R85
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R85;LINKAGE=AD
$\Gamma(\phi\eta)/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
3.1±0.6±0.3		¹ ADAMS	06 CLEO	3.773 $e^+e^- \rightarrow \phi\eta$	NODE=M053R6 NODE=M053R6
••• We do not use the following data for averages, fits, limits, etc. •••					
<19	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$	
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R6;LINKAGE=AD
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.					NODE=M053R6;LINKAGE=AK
$\Gamma(\omega\eta)/\Gamma_{\text{total}}$					Γ_{15}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.4	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R86 NODE=M053R86
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R86;LINKAGE=AD
$\Gamma(\rho^0\eta)/\Gamma_{\text{total}}$					Γ_{16}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<5	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R87 NODE=M053R87
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R87;LINKAGE=AD
$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$					Γ_{17}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
< 3	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R11 NODE=M053R11
••• We do not use the following data for averages, fits, limits, etc. •••					
<50	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$	
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R11;LINKAGE=AD
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.					NODE=M053R11;LINKAGE=AK
$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<6	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R88 NODE=M053R88
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R88;LINKAGE=AD
$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
<5	90	^{1,2} ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R89 NODE=M053R89
¹ Data suggest possible destructive interference with continuum.					NODE=M053R89;LINKAGE=AD
² Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R89;LINKAGE=AS
$\Gamma(\rho\pi)/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
<5	90	^{1,2} ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$	NODE=M053R90 NODE=M053R90
¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.					NODE=M053R90;LINKAGE=AD
² Data suggest possible destructive interference with continuum.					NODE=M053R90;LINKAGE=AS

$\Gamma(K^+K^-)/\Gamma_{total}$

VALUE	DOCUMENT ID	TECN	COMMENT
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••• We do not use the following data for averages, fits, limits, etc. •••

$\sim 10^{-5}$ ¹ DRUZHININ 15 RVUE $e^+e^- \rightarrow \psi(3770)$

¹ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0K_L^0$.

 Γ_{21}/Γ

NODE=M053R00
NODE=M053R00

NODE=M053R00;LINKAGE=A

 $\Gamma(K^*(892)^+K^- + c.c.)/\Gamma_{total}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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<1.4 90 ¹ ADAMS 06 CLEO $e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

 Γ_{22}/Γ

NODE=M053R91
NODE=M053R91

NODE=M053R91;LINKAGE=AS

 $\Gamma(K^*(892)^0\bar{K}^0 + c.c.)/\Gamma_{total}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<1.2 90 ¹ ADAMS 06 CLEO $e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

 Γ_{23}/Γ

NODE=M053R92
NODE=M053R92

NODE=M053R92;LINKAGE=AD

 $\Gamma(K_S^0K_L^0)/\Gamma_{total}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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$2.63^{+1.40}_{-1.59}$

¹ ABLIKIM 24A BES3 $e^+e^- \rightarrow K_S^0K_L^0(K_S^0 \rightarrow \pi^+\pi^-)$

••• We do not use the following data for averages, fits, limits, etc. •••

< 1.2 90 ² CRONIN-HEN..06 CLEO $e^+e^- \rightarrow \psi(3770)$

<21 90 ³ ABLIKIM 04F BES $e^+e^- \rightarrow \psi(3770)$

¹ From the 1σ contour in the B.R. versus ϕ (relative phase between the continuum and $\psi(3770)$ amplitudes) likelihood scan. Mass, total width and electronic width of $\psi(3770)$ fixed at PDG 22 values.

² Using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = (6.38 \pm 0.08^{+0.41}_{-0.30})$ nb from BESSON 06 and $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.

³ Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.

 Γ_{24}/Γ

NODE=M053R3
NODE=M053R3

NODE=M053R3;LINKAGE=A

NODE=M053R3;LINKAGE=CR

NODE=M053R3;LINKAGE=AB

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<11.2 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

••• We do not use the following data for averages, fits, limits, etc. •••

<48 90 ² ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 Γ_{25}/Γ

NODE=M053R21
NODE=M053R21

NODE=M053R21;LINKAGE=HU

NODE=M053R21;LINKAGE=AK

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{total}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<10.6 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

••• We do not use the following data for averages, fits, limits, etc. •••

<62 90 ² ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 Γ_{26}/Γ

NODE=M053R22
NODE=M053R22

NODE=M053R22;LINKAGE=HU

NODE=M053R22;LINKAGE=AK

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{total}$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<58.5 90 305 ABLIKIM 08N BES2 $e^+e^- \rightarrow \psi(3770)$

 Γ_{27}/Γ

NODE=M053R72
NODE=M053R72

 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{total}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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< 6.0 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

••• We do not use the following data for averages, fits, limits, etc. •••

<55 90 ² ABLIKIM 07I BES2 $3.77 e^+e^-$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 Γ_{28}/Γ

NODE=M053R24
NODE=M053R24

NODE=M053R24;LINKAGE=HU

NODE=M053R24;LINKAGE=AK

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<91	90	¹ ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R07
NODE=M053R07

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R07;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<137	90	¹ ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R10
NODE=M053R10

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R10;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<117.4	90	59	ABLIKIM	08N BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R74
NODE=M053R74 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R23
NODE=M053R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.3	90	² ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R23;LINKAGE=HU

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R23;LINKAGE=AK

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8.9	90	218	ABLIKIM	08N BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R70
NODE=M053R70 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	¹ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R53
NODE=M053R53

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R53;LINKAGE=AK

 $\Gamma(\eta3\pi)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<13.4	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R25
NODE=M053R25

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R25;LINKAGE=HU

 $\Gamma(\eta2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<243	90	¹ ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R08
NODE=M053R08

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R08;LINKAGE=AK

 $\Gamma(\eta\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R77
NODE=M053R77

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R77;LINKAGE=AK

 $\Gamma(\eta'3\pi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<24.4	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R26
NODE=M053R26

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R26;LINKAGE=HU

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 9.0	90	1 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R27
 NODE=M053R27

• • • We do not use the following data for averages, fits, limits, etc. • • •

<48	90	2 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R27;LINKAGE=HU
 NODE=M053R27;LINKAGE=AK

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	1 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R28
 NODE=M053R28

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16	90	2 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R28;LINKAGE=HU
 NODE=M053R28;LINKAGE=AK

 $\Gamma(K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4.2	90	14	ABLIKIM	08N BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R71
 NODE=M053R71

 $\Gamma(4(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<16.7	90	1 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R50
 NODE=M053R50

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R50;LINKAGE=AK

 $\Gamma(4(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<30.6	90	1 ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R52
 NODE=M053R52

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R52;LINKAGE=AK

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	1 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R29
 NODE=M053R29

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R29;LINKAGE=HU

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 23.6	90	1 HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R30
 NODE=M053R30

• • • We do not use the following data for averages, fits, limits, etc. • • •

<111	90	2 ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R30;LINKAGE=HU
 NODE=M053R30;LINKAGE=AK

 $\Gamma(K^+K^-\rho^0\pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	1 ABLIKIM	07I BES2	$3.77 e^+e^-$

NODE=M053R58
 NODE=M053R58

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R58;LINKAGE=AK

 $\Gamma(K^+K^-\rho^+\pi^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<146	90	1 ABLIKIM	07I BES2	$3.77 e^+e^-$

NODE=M053R59
 NODE=M053R59

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R59;LINKAGE=AK

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.4	90	¹ HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R32
 NODE=M053R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<66	90	² ABLIKIM 07I	BES2	$3.77 e^+ e^-$
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¹ Using $\sigma_{\text{tot}}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R32;LINKAGE=HU
 NODE=M053R32;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<38	90	¹ ABLIKIM 07I	BES2	$3.77 e^+ e^-$

NODE=M053R60
 NODE=M053R60

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R60;LINKAGE=AK

 $\Gamma(K^{*0} K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<162	90	¹ ABLIKIM 07I	BES2	$3.77 e^+ e^-$

NODE=M053R61
 NODE=M053R61

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R61;LINKAGE=AK

 $\Gamma(K^{*+} K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<323	90	¹ ABLIKIM 07I	BES2	$3.77 e^+ e^-$

NODE=M053R62
 NODE=M053R62

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R62;LINKAGE=AK

 $\Gamma(K^+ K^- \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<26.7	90	24	ABLIKIM 08N	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R73
 NODE=M053R73

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<10.3	90	¹ ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R57
 NODE=M053R57

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R57;LINKAGE=AK

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<36.0	90	¹ ABLIKIM 07F	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R51
 NODE=M053R51

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R51;LINKAGE=AK

 $\Gamma(\eta K^+ K^-)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	¹ HUANG 06A	CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R31
 NODE=M053R31

• • • We do not use the following data for averages, fits, limits, etc. • • •

<31	90	² ABLIKIM 10D	BES2	$e^+ e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{\text{tot}}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R31;LINKAGE=HU
 NODE=M053R31;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\eta K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	¹ ABLIKIM 10D	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R78
 NODE=M053R78

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R78;LINKAGE=AK

$\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R54
 NODE=M053R54

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R54;LINKAGE=AK

 $\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R33
 NODE=M053R33

••• We do not use the following data for averages, fits, limits, etc. •••

<17	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R33;LINKAGE=HU
 NODE=M053R33;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R34
 NODE=M053R34

••• We do not use the following data for averages, fits, limits, etc. •••

<24	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R34;LINKAGE=HU
 NODE=M053R34;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R35
 NODE=M053R35

••• We do not use the following data for averages, fits, limits, etc. •••

<46	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R35;LINKAGE=HU
 NODE=M053R35;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(2(K^+ K^-)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R48
 NODE=M053R48

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R48;LINKAGE=AK

 $\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<3.2	90	18	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R64
 NODE=M053R64

 $\Gamma(K_S^0 K^- \pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<13.3	90	40	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R65
 NODE=M053R65

 $\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.6	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R15
 NODE=M053R15

 $\Gamma(K_S^0 K^- 2\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8.7	90	39	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R66
 NODE=M053R66

 $\Gamma(K_S^0 K^- \pi^+\rho^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R16
 NODE=M053R16

 $\Gamma(K_S^0 K^- \pi^+\eta)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R17
 NODE=M053R17

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{68}/Γ	
<41.8	90	23	ABLIKIM	08M	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R67 NODE=M053R67

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{69}/Γ	
<4.8	90	ABLIKIM	09C	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R18 NODE=M053R18

$$\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{70}/Γ	
<12.2	90	4	ABLIKIM	08M	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R68 NODE=M053R68

$$\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{71}/Γ	
<26.5	90	17	ABLIKIM	08M	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R69 NODE=M053R69

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{72}/Γ	
<4.9	90	ABLIKIM	09C	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R19 NODE=M053R19

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{73}/Γ	
<3.0	90	ABLIKIM	09C	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R75 NODE=M053R75

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{74}/Γ	
<2.2	90	ABLIKIM	09C	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R76 NODE=M053R76

$$\Gamma(K^{*0} K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{75}/Γ	
<9.7	90	¹ ABLIKIM	07F	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R55 NODE=M053R55

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R55;LINKAGE=AK

$$\Gamma(p\bar{p})/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{76}/Γ
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen		¹ AAIJ	17AD	LHCB	$pp \rightarrow B^+ X \rightarrow p\bar{p}K^+ X$
$7.1^+_{-2.9}$	8.6	² ABLIKIM	14L	BES3	$e^+ e^- \rightarrow \psi(3770)$
310 ± 30	684	³ ABLIKIM	14L	BES3	$e^+ e^- \rightarrow \psi(3770)$

¹ AAIJ 17AD reports $B(B^+ \rightarrow \psi(3770)K^+ \rightarrow p\bar{p}K^+)/B(B^+ \rightarrow J/\psi K^+ \rightarrow p\bar{p}K^+) < 0.09$ (0.10) at 90% (95%) CL.

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

OCCUR=2

NODE=M053R98;LINKAGE=C

NODE=M053R98;LINKAGE=A

NODE=M053R98;LINKAGE=B

$$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{77}/Γ
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< 0.4	90	^{1,2} ABLIKIM	14O	BES3	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R09 NODE=M053R09
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$59^{+3}_{-2} \pm 5$		^{1,3} ABLIKIM	14O	BES3	$e^+ e^- \rightarrow \psi(3770)$	OCCUR=2
<12	90	⁴ ABLIKIM	07B	BES2	$e^+ e^- \rightarrow \psi(3770)$	NODE=M053R09;LINKAGE=A

¹ Calculated by the authors using $\sigma(e^+ e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb from BESSON 10.

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

⁴ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R09;LINKAGE=A

NODE=M053R09;LINKAGE=B

NODE=M053R09;LINKAGE=C

NODE=M053R09;LINKAGE=AK

$\Gamma(\rho\bar{\rho}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.8	90	¹ HUANG 06A CLEO	CLEO	$e^+e^- \rightarrow \psi(3770)$
<16	90	² ABLIKIM 07B BES2	BES2	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R36
NODE=M053R36

NODE=M053R36;LINKAGE=HU
NODE=M053R36;LINKAGE=AK

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 $\times 10^{-4}$	90	¹ HUANG 06A CLEO	CLEO	$e^+e^- \rightarrow \psi(3770)$
<1.8 $\times 10^{-4}$	90	² ABLIKIM 21AS BES3	BES3	$e^+e^- \rightarrow \psi(3770)$
<4 $\times 10^{-4}$	90	³ ABLIKIM 07F BES2	BES2	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV. At a 90% CL the lower bound is $> 2.4 \times 10^{-6}$.

³ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R42
NODE=M053R42

NODE=M053R42;LINKAGE=HU
NODE=M053R42;LINKAGE=A

NODE=M053R42;LINKAGE=AK

 $\Gamma(\rho\bar{\rho}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<18.5	90	¹ HUANG 06A CLEO	CLEO	$e^+e^- \rightarrow \psi(3770)$
<73	90	² ABLIKIM 07B BES2	BES2	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R37
NODE=M053R37

NODE=M053R37;LINKAGE=HU
NODE=M053R37;LINKAGE=AK

 $\Gamma(\omega\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	¹ HUANG 06A CLEO	CLEO	$e^+e^- \rightarrow \psi(3770)$
<30	90	² ABLIKIM 07I BES2	BES2	3.77 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Using $\sigma^{\text{obs}} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.

NODE=M053R39
NODE=M053R39

NODE=M053R39;LINKAGE=HU
NODE=M053R39;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.7	90	¹ ABLIKIM 13Q BES3	BES3	$e^+e^- \rightarrow \psi(3770)$
<12	90	² ABLIKIM 07I BES2	BES2	3.77 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Assuming that interference effects between resonance and continuum can be neglected.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R63
NODE=M053R63

NODE=M053R63;LINKAGE=A
NODE=M053R63;LINKAGE=AK

 $\Gamma(\rho\bar{\rho}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	¹ ABLIKIM 07F BES2	BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R49
NODE=M053R49

NODE=M053R49;LINKAGE=AK

 $\Gamma(\eta\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.4	90	¹ HUANG 06A CLEO	CLEO	$e^+e^- \rightarrow \psi(3770)$
<11	90	² ABLIKIM 10D BES2	BES2	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R38
NODE=M053R38

NODE=M053R38;LINKAGE=HU
NODE=M053R38;LINKAGE=AK

$\Gamma(\eta\rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R79
 NODE=M053R79

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R79;LINKAGE=AK

 $\Gamma(\rho^0\rho\bar{p})/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	¹ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R56
 NODE=M053R56

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R56;LINKAGE=AK

 $\Gamma(\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R40
 NODE=M053R40

••• We do not use the following data for averages, fits, limits, etc. •••

<11	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R40;LINKAGE=HU
 NODE=M053R40;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\eta\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R80
 NODE=M053R80

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R80;LINKAGE=AK

 $\Gamma(\pi^0\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R81
 NODE=M053R81

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R81;LINKAGE=AK

 $\Gamma(\phi\rho\bar{p})/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R41
 NODE=M053R41

••• We do not use the following data for averages, fits, limits, etc. •••

<9	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R41;LINKAGE=HU
 NODE=M053R41;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R43
 NODE=M053R43

••• We do not use the following data for averages, fits, limits, etc. •••

< 4.7	90	² ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(3770)$
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<39	90	³ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$
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¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R43;LINKAGE=HU
 NODE=M053R43;LINKAGE=A
 NODE=M053R43;LINKAGE=AK

² Assuming that interference effects between resonance and continuum can be neglected.

³ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

 $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R44
 NODE=M053R44

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R44;LINKAGE=HU

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R45
 NODE=M053R45

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R45;LINKAGE=HU

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R93
NODE=M053R93

NODE=M053R93;LINKAGE=A

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R94
NODE=M053R94

NODE=M053R94;LINKAGE=A

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R95
NODE=M053R95

NODE=M053R95;LINKAGE=A

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R97
NODE=M053R97

NODE=M053R97;LINKAGE=A

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	¹ ABLIKIM	13Q	BES3 $e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M053R96
NODE=M053R96

NODE=M053R96;LINKAGE=A

NODE=M053240

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.64	90	¹ ABLIKIM	15J	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.0	90	² BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
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<0.9	90	³ COAN	06A	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
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¹ This limit is equivalent to $(0.25 \pm 0.21 \pm 0.18) \times 10^{-3}$ branching fraction value.

² Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = 9.22 \pm 0.11 \pm 0.46\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

³ Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R03
NODE=M053R03

NODE=M053R03;LINKAGE=A

NODE=M053R03;LINKAGE=BR

NODE=M053R03;LINKAGE=CO

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.49 ± 0.23 OUR AVERAGE				

2.0 ± 0.8 ± 0.1	202	¹ ABLIKIM	16B	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
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2.48 ± 0.15 ± 0.23	0.6k	ABLIKIM	15J	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
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2.4 ± 0.8 ± 0.2		² ABLIKIM	14H	BES3 $e^+e^- \rightarrow \psi(3770) \rightarrow K_S^0 K^\pm \pi^\mp$
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2.9 ± 0.5 ± 0.4		³ BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}, \gamma\gamma J/\psi$
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NODE=M053R02
NODE=M053R02

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.9 ± 1.4 ± 0.6	54	⁴ BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
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2.8 ± 0.5 ± 0.4	53	⁵ COAN	06A	CLEO $e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
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¹ ABLIKIM 16B reports $(1.94 \pm 0.42 \pm 0.64) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M053R02;LINKAGE=A

² ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)] = (8.51 \pm 2.39 \pm 1.42) \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp) = 0.00349 \pm 0.00031$. Our first error is their experiment's error and our second error is the systematic error from using our best value. We have calculated the best value of $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/2 of $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M053R02;LINKAGE=AB

³ Averages the two measurements from COAN 06A and BRIERE 06.

NODE=M053R02;LINKAGE=BI

⁴ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = 9.07 \pm 0.11 \pm 0.54\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

NODE=M053R02;LINKAGE=BR

⁵ Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R02;LINKAGE=CO

$\Gamma(\gamma\chi_{c1})/\Gamma(J/\psi\pi^+\pi^-)$

 Γ_{102}/Γ_5

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
1.49±0.31±0.26	53 ± 10	¹ COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

NODE=M053R04
NODE=M053R04

¹ Using $B(\psi(3770) \rightarrow J/\psi\pi^+\pi^-) = (1.89 \pm 0.20 \pm 0.20) \times 10^{-3}$ from ADAM 06.

NODE=M053R04;LINKAGE=CO

$\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$

 Γ_{103}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
6.9±0.6 OUR AVERAGE					
6.7±0.7±0.2		2.2k	¹ ABLIKIM	16B BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$
7.3±0.7±0.6		274	BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$

NODE=M053R01
NODE=M053R01

••• We do not use the following data for averages, fits, limits, etc. •••

< 44	90	² COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$
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¹ ABLIKIM 16B reports $(6.88 \pm 0.28 \pm 0.67) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c0})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.22) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M053R01;LINKAGE=B

² Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R01;LINKAGE=CO

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c2})$

 $\Gamma_{103}/\Gamma_{101}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
>8	90	¹ BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R06
NODE=M053R06

¹ Not independent of other results in BRIERE 06.

NODE=M053R06;LINKAGE=BR

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$

 $\Gamma_{103}/\Gamma_{102}$

VALUE	DOCUMENT ID	TECN	COMMENT
2.5±0.6	¹ BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R05
NODE=M053R05

¹ Not independent of other results in BRIERE 06.

NODE=M053R05;LINKAGE=BR

$\Gamma(\gamma\eta_c)/\Gamma_{\text{total}}$

 Γ_{104}/Γ

VALUE	CL%	DOCUMENT ID	TECN
<7 × 10⁻⁴	90	¹ ABLIKIM	14H BES3

NODE=M053R99
NODE=M053R99

¹ ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\eta_c)/\Gamma_{\text{total}}] \times [B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 16 \times 10^{-6}$ which we divide by our best value $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = 2.38 \times 10^{-2}$. We have calculated the best value of $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(1S) \rightarrow K\bar{K}\pi) = 7.1 \times 10^{-2}$.

NODE=M053R99;LINKAGE=AB

$\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE	CL%	DOCUMENT ID	TECN
$<9 \times 10^{-4}$	90	¹ ABLIKIM	14H BES3

¹ ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 5.6 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp) = 6.3 \times 10^{-3}$.

We have calculated the best value of $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(2S) \rightarrow K\bar{K}\pi) = 1.9 \times 10^{-2}$.

NODE=M053R20
NODE=M053R20

NODE=M053R20;LINKAGE=AB

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{106}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$

¹ Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.

NODE=M053R14
NODE=M053R14

NODE=M053R14;LINKAGE=PE

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{107}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	¹ PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$

¹ Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.

NODE=M053R13
NODE=M053R13

NODE=M053R13;LINKAGE=PE

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{108}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	PEDLAR	09 CLE3	$\psi(2S) \rightarrow \gamma X$

NODE=M053R12
NODE=M053R12

 $\psi(3770)$ REFERENCES

ABLIKIM	24A	PRL 132 131901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62650
ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
HANHART	24	EPJ C84 483	C. Hanhart <i>et al.</i>	(JULI, BONN, SIEG+)	REFID=62695
ABLIKIM	23BC	PR D108 052015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62423
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23V	PR D107 L091101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62269
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	21Z	PRL 127 082002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61265
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59697
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
SHAMOV	17	PL B769 187	A.G. Shamov, K.Yu. Todyshv		REFID=57900
ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57126
ABLIKIM	15J	PR D91 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56775
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)	REFID=56962
ABLIKIM	14H	PR D89 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55899
ABLIKIM	14L	PL B735 101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55903
ABLIKIM	14O	PR D90 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55906
BONVICINI	14	PR D89 072002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=55798
ABLIKIM	13Q	PR D87 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55393
ANASHIN	12A	PL B711 292	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54055
ABLIKIM	10D	EPJ C66 11	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53350
BESSION	10	PRL 104 159901 (err.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
ABLIKIM	09C	EPJ C64 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=53134
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
ABLIKIM	08H	PRL 101 102004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52254
ABLIKIM	08M	PL B670 179	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52569
ABLIKIM	08N	PL B670 184	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52570
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
PAKHOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
ABLIKIM	07B	PL B650 111	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51704
ABLIKIM	07E	PL B652 238	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51882
ABLIKIM	07F	PL B656 30	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51940
ABLIKIM	07I	EPJ C52 805	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52045
ABLIKIM	07K	PR D76 122002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52073
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
DOBBS	07	PR D76 112001	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52075
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06N	PL B641 145	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51131
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
ADAMS	06	PR D73 012002	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50990
BESSION	06	PRL 96 092002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51041
Also		PRL 104 159901 (err.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
BRIERE	06	PR D74 031106	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51155
CRONIN-HEN...	06	PR D74 012005	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=51156
HUANG	06A	PRL 96 032003	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=50999
BAI	05	PL B605 63	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50332
HE	05	PRL 95 121801	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=50924
Also		PRL 96 199903 (err.)	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51211
ABLIKIM	04F	PR D70 077101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50185
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ADLER	88C	PRL 60 89	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40361
SCHINDLER	80	PR D21 2716	R.H. Schindler <i>et al.</i>	(Mark II Collab.)	REFID=22222
BACINO	78	PRL 40 671	W.J. Bacino <i>et al.</i>	(SLAC, UCLA, UCI)	REFID=11437
RAPIDIS	77	PRL 39 526	P.A. Rapidis <i>et al.</i>	(LGW Collab.)	REFID=22220

NODE=M053

$\psi_2(3823)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

I, J, P need confirmation.

was $\psi(3823), X(3823)$

Seen by BHARDWAJ 13 in $B \rightarrow \chi_{c1} \gamma K$ and ABLIKIM 15S in $e^+ e^- \rightarrow \pi^+ \pi^- \gamma \chi_{c1}$ decays as a narrow peak in the invariant mass distribution of the $\chi_{c1} \gamma$ system. Properties consistent with the $\psi_2(1^3D_2) c \bar{c}$ state.

NODE=M212

NODE=M212

 $\psi_2(3823)$ MASS

NODE=M212M

NODE=M212M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3823.51 ± 0.34 OUR AVERAGE				
3824.5 ± 2.4 ± 1.0	30	¹ ABLIKIM	23J BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$
3823.12 ± 0.43 ± 0.13	120	ABLIKIM	22R BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
3824.08 ± 0.53 ± 0.14	137	² AAIJ	20S LHCB	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
3823.1 ± 1.8 ± 0.7	33 ± 10	³ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

• • • We do not use the following data for averages, fits, limits, etc. • • •

⁴ ABLIKIM 15S BES3 $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

¹ Using the measured $m_{\psi_2(3823)} - m_{\psi(2S)}$ and assuming $m_{\psi(2S)} = 3686.097$ MeV from PDG 22.

² Using the measured $m_{\psi_2(3823)} - m_{\psi(2S)} = 137.98 \pm 0.53 \pm 0.14$ MeV.

³ From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics. Corrected for the measured $\psi(2S)$ mass using $B \rightarrow \psi(2S) K \rightarrow (\gamma \chi_{c1}) K$ decays.

⁴ From a simultaneous unbinned maximum likelihood fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1} \gamma$ and $\psi_2(3823) \rightarrow \chi_{c1} \gamma$ together, with floating mass scale offset for $\psi(2S)$, floating $\psi_2(3823)$ mass, and zero $\psi_2(3823)$ width, resulting in a significance of 5.9σ when including systematic uncertainties. Superseded by ABLIKIM 22R.

NODE=M212M;LINKAGE=D

NODE=M212M;LINKAGE=C

NODE=M212M;LINKAGE=A

NODE=M212M;LINKAGE=B

 $m_{\psi_2(3823)} = m_{\psi(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
137.98 ± 0.53 ± 0.14	137	¹ AAIJ	20S LHCB	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

¹ AAIJ 20S also reports $m_{\chi_{c1}(3872)} - m_{\psi_2(3823)} = 47.50 \pm 0.53 \pm 0.13$ MeV.

NODE=M212A00

NODE=M212A00

NODE=M212A00;LINKAGE=A

 $\psi_2(3823)$ WIDTH

NODE=M212W

NODE=M212W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 2.9	90	120	ABLIKIM	22R BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 18.8	90	30	¹ ABLIKIM	23J BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$
< 5.2	90		² AAIJ	20S LHCB	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
< 16	90		³ ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
< 24	90		⁴ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

¹ From a fit of $e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$ data at \sqrt{s} values from 4.23 to 4.70 GeV to a Breit-Wigner function with floating width, using the Bayesian approach.

² AAIJ 20S also provides a limit of < 6.6 MeV with 95% CL.

³ From a fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to a Breit-Wigner function with the mass fixed from the likelihood fit above, Gaussian resolution smearing, and floating width.

⁴ From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics.

NODE=M212W;LINKAGE=D

NODE=M212W;LINKAGE=C

NODE=M212W;LINKAGE=B

NODE=M212W;LINKAGE=A

$\psi_2(3823)$ DECAY MODESBranching fractions are given relative to the one **DEFINED AS 1**.

NODE=M212215;NODE=M212

NODE=M212

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S)\pi^+\pi^-$	<0.06	90%
Γ_2 $J/\psi(1S)\pi^0\pi^0$	<0.11	90%
Γ_3 $J/\psi(1S)\pi^0$	<0.030	90%
Γ_4 $J/\psi(1S)\eta$	<0.14	90%
Γ_5 $\chi_{c0}\gamma$	<0.24	90%
Γ_6 $\chi_{c1}\gamma$	DEFINED AS 1	
Γ_7 $\chi_{c2}\gamma$	0.28 $^{+0.14}_{-0.11}$	

DESIG=3

DESIG=5

DESIG=6

DESIG=7

DESIG=4

DESIG=1

DESIG=2

 $\psi_2(3823)$ BRANCHING RATIOS

NODE=M212225

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M212R00
NODE=M212R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$
 seen 137 ± 26 AAIJ 20S LHCb $B^+ \rightarrow J/\psi\pi^+\pi^-K^+$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R00;LINKAGE=A

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(\chi_{c1}\gamma)$ Γ_1/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M212R06
NODE=M212R06

<0.06 90 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R06;LINKAGE=A

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(\chi_{c1}\gamma)$ Γ_2/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M212R07
NODE=M212R07

<0.11 90 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R07;LINKAGE=A

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(\chi_{c1}\gamma)$ Γ_3/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M212R08
NODE=M212R08

<0.03 90 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R08;LINKAGE=A

$\Gamma(J/\psi(1S)\eta)/\Gamma(\chi_{c1}\gamma)$ Γ_4/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M212R09
NODE=M212R09

<0.14 90 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R09;LINKAGE=A

$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M212R10
NODE=M212R10

$4.4^{+2.5}_{-1.9} \pm 0.9$ 1 AAIJ 22D LHCb $B^+ \rightarrow J/\psi(1S)\eta K^+$

1 Using the branching ratio for $B^+ \rightarrow \psi_2(3823)K^+$ with $\psi_2(3823) \rightarrow J/\psi(1S)\pi^+\pi^-$ from AAIJ 20S.

NODE=M212R10;LINKAGE=A

$\Gamma(\chi_{c0}\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M212R04
NODE=M212R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen 1 ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

1 From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R04;LINKAGE=A

$\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M212R01
 NODE=M212R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	120	¹ ABLIKIM	22R	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
seen	63 ± 9	² ABLIKIM	210	BES3	$e^+e^- \rightarrow \pi^+\pi^-X$
seen	16 ± 5	³ ABLIKIM	210	BES3	$e^+e^- \rightarrow \pi^0\pi^0X$
seen	33 ± 10	⁴ BHARDWAJ	13	BELL	$B^\pm \rightarrow \chi_{c1}\gamma K^\pm$

OCCUR=2

¹ From a fit to the $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak R with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV, which leads to $\Gamma(e^+e^-)B(R \rightarrow \pi^+\pi^-\psi_2(3823))B(\psi_2(3823) \rightarrow \chi_{c1}\gamma) = 0.57 \pm 0.08$ eV.

NODE=M212R01;LINKAGE=D

² From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$. Signal has a 11.8 σ significance.

NODE=M212R01;LINKAGE=B

³ From a fit of the invariant $\pi^0\pi^0$ recoil-mass distribution. Signal has a 4.3 σ significance.

NODE=M212R01;LINKAGE=C

⁴ BHARDWAJ 13 reports $B(B^\pm \rightarrow \psi_2(3823)K^\pm) \times B(\psi_2(3823) \rightarrow \gamma\chi_{c1}) = (9.7 \pm 2.8 \pm 1.1) \times 10^{-6}$ with statistical significance 3.8 σ .

NODE=M212R01;LINKAGE=A

 $\Gamma(\chi_{c0}\gamma)/\Gamma(\chi_{c1}\gamma)$ Γ_5/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M212R05
 NODE=M212R05

<0.24 90 ¹ ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R05;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M212R02
 NODE=M212R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	¹ ABLIKIM	210	BES3	$e^+e^- \rightarrow \pi^+\pi^-X$
not seen	² ABLIKIM	15s	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
not seen	³ BHARDWAJ	13	BELL	$B^\pm \rightarrow \chi_{c2}\gamma K^\pm$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$. Signal has a 3.2 σ significance.

NODE=M212R02;LINKAGE=C

² From a simultaneous unbinned maximum likelihood fit of $e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$ data (the $\pi^+\pi^-$ recoil mass) taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c2}\gamma$ and $\psi_2(3823) \rightarrow \chi_{c2}\gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi_2(3823)$ mass floating (fixed to that above), and zero $\psi_2(3823)$ width.

NODE=M212R02;LINKAGE=B

³ BHARDWAJ 13 reports $B(B^\pm \rightarrow \psi_2(3823)K^\pm) \times B(\psi_2(3823) \rightarrow \gamma\chi_{c2}) < 3.6 \times 10^{-6}$ at 90% CL.

NODE=M212R02;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma)/\Gamma(\chi_{c1}\gamma)$ Γ_7/Γ_6

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M212R03
 NODE=M212R03

$0.28^{+0.14}_{-0.11} \pm 0.02$ 9 ± 4 ¹ ABLIKIM 210 BES3 $e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.42	90	² ABLIKIM	15s	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
<0.41	90	BHARDWAJ	13	BELL	$B^\pm \rightarrow \chi_{c1/c2}\gamma K^\pm$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R03;LINKAGE=B

² From a simultaneous unbinned maximum likelihood fit of $e^+e^- \rightarrow \pi^+\pi^-\chi_{c1(2)}\gamma$ data (the $\pi^+\pi^-$ recoil mass) taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1(2)}\gamma$ and $\psi_2(3823) \rightarrow \chi_{c1(2)}\gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi_2(3823)$ mass floating (fixed to that above), and zero $\psi_2(3823)$ width.

NODE=M212R03;LINKAGE=A

 $\psi_2(3823)$ REFERENCES

NODE=M212

ABLIKIM	23J	JHEP 2302 171	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62052
AAIJ	22D	JHEP 2204 046	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61647
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61664
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	210	PR D103 L091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61121
AAIJ	20S	JHEP 2008 123	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60526
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56784
BHARDWAJ	13	PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=55412

$\psi_3(3842)$
 $I^G(J^{PC}) = 0^-(3^{--})$
 J, P need confirmation.

 J^P has not been measured, 3^- is the quark model prediction.

NODE=M241

NODE=M241

NODE=M241M

NODE=M241M

 $\psi_3(3842)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3842.71 ± 0.16 ± 0.12	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241W

NODE=M241W

 $\psi_3(3842)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.79 ± 0.51 ± 0.35	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241215;NODE=M241

 $\psi_3(3842)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^+ D^-$	seen
$\Gamma_2 \quad D^0 \bar{D}^0$	seen

DESIG=1

DESIG=2

 $\psi_3(3842)$ BRANCHING RATIOS

NODE=M241225

 $\Gamma(D^+ D^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$
NODE=M241R01
NODE=M241R01

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen ¹ ABLIKIM 22AL BES3 $e^+ e^- \rightarrow \pi^+ \pi^- D^+ D^-$

¹ From a fit to the $\pi^+ \pi^-$ recoil mass for $e^+ e^- \rightarrow D^+ D^- \pi^+ \pi^-$.

NODE=M241R01;LINKAGE=A

 $\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$
NODE=M241R02
NODE=M241R02

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

 $\psi_3(3842)$ REFERENCES

NODE=M241

ABLIKIM	22AL PR D106 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	19M JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=61884
REFID=59697

$\chi_{c0}(3860)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M237

OMITTED FROM SUMMARY TABLE

The assignment $J^P = 0^+$ is preferred over 2^+ by 2.5 sigma.

NODE=M237

Observed by CHILIKIN 17 using full amplitude analysis of the process $e^+ e^- \rightarrow J/\psi D \bar{D}$, where $D = D^0, D^+$. Not seen by AAIJ 20AI in the decay $B^+ \rightarrow D^+ D^- K^+$.

 $\chi_{c0}(3860)$ MASS

NODE=M237M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3862^{+26+40}_{-32-13}	CHILIKIN	17	BELL $e^+ e^- \rightarrow J/\psi D \bar{D}$

NODE=M237M

 $\chi_{c0}(3860)$ WIDTH

NODE=M237W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$201^{+154+88}_{-67-82}$	CHILIKIN	17	BELL $e^+ e^- \rightarrow J/\psi D \bar{D}$

NODE=M237W

 $\chi_{c0}(3860)$ DECAY MODES

NODE=M237215;NODE=M237

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \bar{D}^0$	seen
$\Gamma_2 \quad D^+ D^-$	seen

DESIG=1

DESIG=2

 $\chi_{c0}(3860)$ BRANCHING RATIOS

NODE=M237220

$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	CHILIKIN	17	BELL $e^+ e^- \rightarrow J/\psi D^0 \bar{D}^0$	

NODE=M237R00
NODE=M237R00

$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	CHILIKIN	17	BELL $e^+ e^- \rightarrow J/\psi D^+ D^-$	

NODE=M237R01
NODE=M237R01 $\chi_{c0}(3860)$ REFERENCES

NODE=M237

AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHILIKIN	17	PR D95 112003	K. Chilikin <i>et al.</i>	(BELLE Collab.) JPC

REFID=60739
REFID=57995

$\chi_{c1}(3872)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M176

also known as $X(3872)$

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M176

First observed by CHOI 03 in $B \rightarrow K\pi^+\pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+\pi^- J/\psi(1S)$ final state. Isovector hypothesis excluded by AUBERT 05B and CHOI 11.

AAIJ 13Q perform a full five-dimensional amplitude analysis of the angular correlations between the decay products in $B^+ \rightarrow \chi_{c1}(3872)K^+$ decays, where $\chi_{c1}(3872) \rightarrow J/\psi\pi^+\pi^-$ and $J/\psi \rightarrow \mu^+\mu^-$, which unambiguously gives the $J^{PC} = 1^{++}$ assignment under the assumption that the $\pi^+\pi^-$ and J/ψ are in an S -wave. AAIJ 15AO extend this analysis with more data to limit D -wave contributions to $< 4\%$ at 95% CL.

See the review on "Spectroscopy of Mesons Containing Two Heavy Quarks."

 $\chi_{c1}(3872)$ T-MATRIX POLE \sqrt{s}

NODE=M176PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M176PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$(3871.70 \pm 0.15^{+0.07}_{-0.08}) - i(0.19 \pm 0.08^{+0.14}_{-0.19})$	¹ ABLIKIM	24C BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176PP

¹From simultaneous line shape fits of $e^+e^- \rightarrow \gamma\chi_{c1}(3872) \rightarrow \gamma[D^0\bar{D}^0\pi^0]$ and $\gamma[J/\psi\pi^+\pi^-]$. The most prominent pole is reported at $7.04 \pm 0.15^{+0.07}_{-0.08}$ MeV above the $D^0\bar{D}^0\pi^0$ threshold of 3864.66 MeV on the first sheet with respect to the $D^{*0}\bar{D}^0$ channel. The uncertainty in the D^0 width is included in the uncertainty of the pole mass.

NODE=M176PP;LINKAGE=A

 $\chi_{c1}(3872)$ MASS FROM $J/\psi X$ MODE

NODE=M176M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.64 ± 0.06 OUR AVERAGE				
3870.2 ± 0.7 ± 0.3	24.6	ABLIKIM	23W BES3	$e^+e^- \rightarrow J/\psi(1S)\pi^+\pi^-\omega$
3871.64 ± 0.06 ± 0.01	19.8k	¹ AAIJ	20S LHCB	$B^+ \rightarrow J/\psi\pi^+\pi^-K^+$
3871.9 ± 0.7 ± 0.2	20	ABLIKIM	14 BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
3871.95 ± 0.48 ± 0.12	0.6k	AAIJ	12H LHCB	$pp \rightarrow J/\psi\pi^+\pi^-X$
3871.85 ± 0.27 ± 0.19	170	² CHOI	11 BELL	$B \rightarrow K\pi^+\pi^-J/\psi$
3873 $\begin{smallmatrix} + 1.8 \\ - 1.6 \end{smallmatrix}$ ± 1.3	27	³ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3871.61 ± 0.16 ± 0.19	6k	^{3,4} AALTONEN	09AU CDF2	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
3871.4 ± 0.6 ± 0.1	93.4	AUBERT	08Y BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$
3868.7 ± 1.5 ± 0.4	9.4	AUBERT	08Y BABR	$B^0 \rightarrow K_S^0 J/\psi\pi^+\pi^-$
3871.8 ± 3.1 ± 3.0	522	^{3,5} ABAZOV	04F D0	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3871.57 ± 0.09	155	⁶ AAIJ	23AP LHCB	$B_s^0 \rightarrow J/\psi 2(\pi^+\pi^-)$
3871.695 ± 0.067 ± 0.068	15.6k	⁷ AAIJ	20AD LHCB	$pp \rightarrow J/\psi\pi^+\pi^-X$
3871.59 ± 0.06 ± 0.03	4.2k	⁸ AAIJ	20S LHCB	$B^+ \rightarrow J/\psi\pi^+\pi^-K^+$
3873.3 ± 1.1 ± 1.0	45	⁹ ABLIKIM	19V BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
3860.0 ± 10.4	13.6	^{3,10} AGHASYAN	18A COMP	$\gamma^* N \rightarrow X\pi^\pm N'$
3868.6 ± 1.2 ± 0.2	8	¹¹ AUBERT	06 BABR	$B^0 \rightarrow K_S^0 J/\psi\pi^+\pi^-$

NODE=M176M

OCCUR=2

OCCUR=2

3871.3 ± 0.6 ± 0.1	61	¹¹ AUBERT	06	BABR	$B^- \rightarrow K^- J/\psi \pi^+ \pi^-$
3873.4 ± 1.4	25	¹² AUBERT	05R	BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
3871.3 ± 0.7 ± 0.4	730	^{3,13} ACOSTA	04	CDF2	$p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3872.0 ± 0.6 ± 0.5	36	¹⁴ CHOI	03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$
3836 ± 13	58	^{3,15} ANTONIAZZI	94	E705	$300 \pi^\pm \text{Li} \rightarrow J/\psi \pi^+ \pi^- X$

OCCUR=2

¹ Calculated from $m_{\chi_{c1}(3872)} - m_{\psi(2S)} = 185.54 \pm 0.06$ MeV obtained by combining the data with $\chi_{c1}(3872)$ produced in B^+ decays from AAIJ 20S and inclusive b -hadron decays from AAIJ 20AD and using $m_{\psi(2S)} = 3686.097$ MeV. Breit-Wigner parametrization.

NODE=M176M;LINKAGE=F

² The mass difference for the $\chi_{c1}(3872)$ produced in B^+ and B^0 decays is $(-0.71 \pm 0.96 \pm 0.19)$ MeV.

NODE=M176M;LINKAGE=CO

³ Width consistent with detector resolution.

NODE=M176M;LINKAGE=AC

⁴ A possible equal mixture of two states with a mass difference greater than 3.6 MeV/ c^2 is excluded at 95% CL.

NODE=M176M;LINKAGE=AA

⁵ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{J/\psi}$ using $m_{J/\psi} = 3096.916$ MeV.

NODE=M176M;LINKAGE=AB

⁶ From a fit of a relativistic S -wave Breit-Wigner convolved with the detector resolution. The width of $\chi_{c1}(3872)$ is constrained to the PDG 22 value. Systematic errors not evaluated.

NODE=M176M;LINKAGE=H

⁷ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays and $m_{\psi(2S)} = 3686.097 \pm 0.010$ MeV. Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.

NODE=M176M;LINKAGE=D

⁸ Using Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.

NODE=M176M;LINKAGE=E

⁹ Fit with fixed width and including two resonances, $\chi_{c0}(3915)$ and $X(3960)$.

NODE=M176M;LINKAGE=B

¹⁰ Could be a different state.

NODE=M176M;LINKAGE=A

¹¹ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. Superseded by AUBERT 08Y.

NODE=M176M;LINKAGE=AE

¹² Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$ MeV. Superseded by AUBERT 06.

NODE=M176M;LINKAGE=AU

¹³ Superseded by AALTONEN 09AU.

NODE=M176M;LINKAGE=AT

¹⁴ Superseded by CHOI 11.

NODE=M176M;LINKAGE=CH

¹⁵ A lower mass value can be due to an incorrect momentum scale for soft pions.

NODE=M176M;LINKAGE=AN

$\chi_{c1}(3872)$ MASS FROM $\bar{D}^{*0} D^0$ MODE

NODE=M176MD0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$3873.71^{+0.56}_{-0.50} \pm 0.13$		¹ HIRATA	23	BELL $B^0 \rightarrow D^0 \bar{D}^{*0} K^0$ $B^+ \rightarrow D^0 \bar{D}^{*0} K^+$
$3872.9^{+0.6}_{-0.4} \pm 0.4$	50	^{2,3} AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
$3875.1^{+0.7}_{-0.5} \pm 0.5$	33 ± 6	³ AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$
3875.2 ± 0.7	24 ± 6	^{3,4} GOKHROO	06	BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

NODE=M176MD0

¹ From a fit of a Breit-Wigner function with energy dependent width.

NODE=M176MD0;LINKAGE=A

² Calculated from the measured $m_{\chi_{c1}(3872)} - m_{D^{*0}} - m_{\bar{D}^0} = 1.1^{+0.6+0.1}_{-0.4-0.3}$ MeV.

NODE=M176MD0;LINKAGE=AS

³ Experiments report $D^{*0} \bar{D}^0$ invariant mass above $D^{*0} \bar{D}^0$ threshold because D^{*0} decay products are kinematically constrained to the D^{*0} mass, even though the D^{*0} may decay off-shell.

NODE=M176MD0;LINKAGE=AU

⁴ Superseded by AUSHEV 10.

NODE=M176MD0;LINKAGE=GO

$m_{\chi_{c1}(3872)} - m_{J/\psi}$

NODE=M176DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$774.9 \pm 3.1 \pm 3.0$	522	ABAZOV	04F D0	$p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M176DM

$m_{\chi_{c1}(3872)} - m_{\psi(2S)}$

NODE=M176DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$185.598 \pm 0.067 \pm 0.068$	15.6k	¹ AAIJ	20AD LHCB	$p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
185.54 ± 0.06	19.8k	² AAIJ	20S LHCB	$p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
187.4 ± 1.4	25	³ AUBERT	05R BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

NODE=M176DM2

¹ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays. Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.

² Combining $m_{\chi_{c1}(3872)} - m_{\psi(2S)} = 185.49 \pm 0.06 \pm 0.03$ MeV from AAIJ 20S and the measured mass difference from AAIJ 20AD. Breit-Wigner parametrization.

³ Superseded by AUBERT 06.

NODE=M176DM2;LINKAGE=A

NODE=M176DM2;LINKAGE=E

NODE=M176DM2;LINKAGE=AU

$\chi_{c1}(3872)$ WIDTH

NODE=M176W

NODE=M176W

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
1.19±0.21 OUR AVERAGE Error includes scale factor of 1.1.				
1.39±0.24±0.10	15.6k	¹ AAIJ	20AD LHCb	$p p \rightarrow J/\psi \pi^+ \pi^- X$
0.96 ^{+0.19} _{-0.18} ±0.21	4.2k	² AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

OCCUR=3

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.4	90	ABLIKIM	14 BES3	$e^+ e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$
<1.2	90	CHOI	11 BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$
<3.3	90	AUBERT	08Y BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
<4.1	90 69	AUBERT	06 BABR	$B \rightarrow K \pi^+ \pi^- J/\psi$
<2.3	90 36	³ CHOI	03 BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

¹ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays. Breit-Wigner parametrization.

² Using Breit-Wigner parametrization. Partially overlapping dataset with that of AAIJ 20AD.

³ Superseded by CHOI 11.

NODE=M176W;LINKAGE=E

NODE=M176W;LINKAGE=F

NODE=M176W;LINKAGE=CH

$\chi_{c1}(3872)$ WIDTH FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.2 ^{+2.2} _{-1.5} ±0.4		¹ HIRATA	23 BELL	$B^0 \rightarrow D^0 \bar{D}^{*0} K^0$, $B^+ \rightarrow D^0 \bar{D}^{*0} K^+$
3.9 ^{+2.8+0.2} _{-1.4-1.1}	50	² AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$
3.0 ^{+1.9} _{-1.4} ±0.9	33 ± 6	AUBERT	08B BABR	$B \rightarrow \bar{D}^{*0} D^0 K$

¹ From a fit of a Breit-Wigner function with energy dependent width.

² With a measured value of $B(B \rightarrow \chi_{c1}(3872) K) \times B(\chi_{c1}(3872) \rightarrow D^{*0} \bar{D}^0) = (0.80 \pm 0.20 \pm 0.10) \times 10^{-4}$, assumed to be equal for both charged and neutral modes.

NODE=M176WD0

NODE=M176WD0

NODE=M176WD0;LINKAGE=B

NODE=M176WD0;LINKAGE=AU

$\chi_{c1}(3872)$ DECAY MODES

NODE=M176215;NODE=M176

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^+ e^-$	< 2.7 $\times 10^{-7}$	90%
Γ_2 $\pi^+ \pi^- \pi^0$	< 1.0 %	90%
Γ_3 $\pi^+ \pi^- J/\psi(1S)$	(4.3 ± 1.4) %	
Γ_4 $\pi^+ \pi^- \pi^0 J/\psi(1S)$	not seen	
Γ_5 $\omega \eta_c(1S)$	< 40 %	90%
Γ_6 $\rho(770)^0 J/\psi(1S)$	(3.4 ± 1.1) %	
Γ_7 $\omega J/\psi(1S)$	(5.0 ± 1.9) %	
Γ_8 $\phi \phi$	not seen	
Γ_9 $D^0 \bar{D}^0 \pi^0$	(55 ± 28) %	
Γ_{10} $\bar{D}^{*0} D^0$	(46 ± 16) %	
Γ_{11} $\gamma \gamma$	< 13 %	90%
Γ_{12} $D^0 \bar{D}^0$	< 32 %	90%
Γ_{13} $D^+ D^-$	< 22 %	90%
Γ_{14} $\pi^0 \chi_{c2}$	< 5 %	90%
Γ_{15} $\pi^0 \chi_{c1}$	(3.8 ⁺ _{-1.9} 1.9 ⁻) %	
Γ_{16} $\pi^0 \chi_{c0}$	< 16 %	90%
Γ_{17} $\pi^+ \pi^- \eta_c(1S)$	< 16 %	90%
Γ_{18} $\pi^0 \pi^0 \chi_{c0}$	< 7 %	90%
Γ_{19} $\pi^0 \pi^0 \chi_{c1}$	< 5 %	90%
Γ_{20} $\pi^0 \pi^0 \chi_{c2}$	< 2.2 %	90%
Γ_{21} $\pi^+ \pi^- \chi_{c0}$	< 2.4 %	90%
Γ_{22} $\pi^+ \pi^- \chi_{c1}$	< 8 $\times 10^{-3}$	90%
Γ_{23} $\rho \bar{\rho}$	< 2.7 $\times 10^{-5}$	95%
Γ_{24} $\pi^+ \pi^- \eta$	< 5 $\times 10^{-3}$	90%

DESIG=1

DESIG=29

DESIG=2

DESIG=25

DESIG=24

DESIG=32

DESIG=13

DESIG=26

DESIG=8

DESIG=12

DESIG=5

DESIG=6

DESIG=7

DESIG=20

DESIG=18

DESIG=19

DESIG=14

DESIG=28

DESIG=36

DESIG=37

DESIG=27

DESIG=17

DESIG=16

DESIG=34

Radiative decays

Γ_{25}	$\gamma D^+ D^-$	< 4	%	90%
Γ_{26}	$\gamma \bar{D}^0 D^0$	< 7	%	90%
Γ_{27}	$\gamma J/\psi$	$(10 \pm 4) \times 10^{-3}$		
Γ_{28}	$\gamma \chi_{c1}$	< 1.0	%	90%
Γ_{29}	$\gamma \chi_{c2}$	< 4	%	90%
Γ_{30}	$\gamma \psi(2S)$	possibly seen		
Γ_{31}	$\gamma \psi_2(3823)$	< 3.3	$\times 10^{-3}$	90%

NODE=M176;CLUMP=B
 DESIG=21
 DESIG=23
 DESIG=9
 DESIG=3
 DESIG=15
 DESIG=11
 DESIG=35

C-violating decays

Γ_{32}	$\eta J/\psi$	< 2.1	%	90%
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NODE=M176;CLUMP=A
 DESIG=4

 $\chi_{c1}(3872)$ PARTIAL WIDTHS $\Gamma(e^+e^-)$ Γ_1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.32	90	1 ABLIKIM 230	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 4.3	90	2 ABLIKIM 15V	BES3	$4.0-4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
< 280	90	3 YUAN 04	RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

NODE=M176220

NODE=M176W1
 NODE=M176W1

¹ Fit to cross section using a total width value of 1.19 ± 0.21 MeV and $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = (3.8 \pm 1.2)\%$ from PDG 20.

NODE=M176W1;LINKAGE=C

² ABLIKIM 15V reports this limit from the measurement of $\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) \times \Gamma(\chi_{c1}(3872) \rightarrow e^+e^-) / \Gamma < 0.13$ eV using $\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) / \Gamma = 3\%$.

NODE=M176W1;LINKAGE=B

³ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^- \ell^+ \ell^-$. Assuming that $\Gamma(\pi^+\pi^- J/\psi)$ of $\chi_{c1}(3872)$ is the same as that of $\psi(2S)$ (85.4 keV).

NODE=M176W1;LINKAGE=A

 $\chi_{c1}(3872) \Gamma(i)\Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M176230

 $\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5×10^{-3}	90	1 ABLIKIM 230	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 0.13	90	ABLIKIM 15V	BES3	$4.0-4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
< 6.2	90	2,3 AUBERT 05D	BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
< 8.3	90	3 DOBBS 05	CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
< 10	90	4 YUAN 04	RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

NODE=M176G1
 NODE=M176G1

¹ Fit to cross section using a total width value of 1.19 ± 0.21 MeV from PDG 20.

NODE=M176G1;LINKAGE=B

² Using $B(\chi_{c1}(3872) \rightarrow J/\psi \pi^+ \pi^-) \cdot B(J/\psi \rightarrow \mu^+ \mu^-) \cdot \Gamma(\chi_{c1}(3872) \rightarrow e^+ e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

NODE=M176G1;LINKAGE=AU

³ Assuming $\chi_{c1}(3872)$ has $J^{PC} = 1^{--}$.

NODE=M176G1;LINKAGE=DO

⁴ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^- \ell^+ \ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176G1;LINKAGE=A

 $\chi_{c1}(3872) \Gamma(i)\Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M176232

 $\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_{11} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$5.5^{+4.1}_{-3.8} \pm 0.7$		3	1 TERAMOTO 21	BELL	$e^+e^- \rightarrow \gamma^* \gamma$ at $\Upsilon(nS)$
< 12.9	90		2 DOBBS 05	CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi \gamma$

NODE=M176H1
 NODE=M176H1

¹ Measured in single-tag two-photon production assuming Q^2 dependence of a $c\bar{c}$ meson model. Here, $\Gamma(\chi_{c1}(3872) \rightarrow \gamma\gamma)$ is the reduced two-photon decay width, $\tilde{\Gamma}_{\gamma\gamma}$.

NODE=M176H1;LINKAGE=A

² Assuming $\chi_{c1}(3872)$ has positive C parity and spin 0.

NODE=M176H1;LINKAGE=DO

 $\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_{11} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7	90	1 LEES 12AD	BABR	$e^+e^- \rightarrow e^+e^- \omega J/\psi$

NODE=M176G01
 NODE=M176G01

¹ Assuming $\chi_{c1}(3872)$ has spin 2.

NODE=M176G01;LINKAGE=LE

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{17}\Gamma_{11}/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<11.1	90	LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$	NODE=M176G02 NODE=M176G02

 $\chi_{c1}(3872)$ BRANCHING RATIOS

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT	

<1.0 (CL = 90%) [$<0.8\%$ (CL = 90%) OUR 2024 BEST LIMIT]

<1.0 90 1,2 YIN 23 BELL $B^+ \rightarrow \chi_{c1}(3872)K^+$

••• We do not use the following data for averages, fits, limits, etc. •••

<1.3 90 2,3 YIN 23 BELL $B^0 \rightarrow \chi_{c1}(3872)K^0$

¹ YIN 23 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 1.9 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 1.9 \times 10^{-4}$.

² Assuming the decay products, $\pi^+\pi^-\pi^0$, are uniformly distributed in phase space. The limit is the 90% "credible" upper limit (i.e. Bayesian).

³ YIN 23 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(B^0 \rightarrow \chi_{c1}(3872)K^0)] < 1.5 \times 10^{-6}$ which we divide by our best value $B(B^0 \rightarrow \chi_{c1}(3872)K^0) = 1.1 \times 10^{-4}$.

$\Gamma(\pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	

0.043 ± 0.014 OUR AVERAGE

[0.035 ± 0.009 OUR 2024 AVERAGE]

0.043 ± 0.002 ± 0.013 ¹ AAIJ 20S LHC B $B^+ \rightarrow J/\psi\pi^+\pi^-K^+$

0.047 ± 0.005 ± 0.015 ² CHOI 11 BELL $B^+ \rightarrow \pi^+\pi^-J/\psi K^+$

0.045 ± 0.009 ± 0.014 93 ^{3,4} AUBERT 08Y BABR $B \rightarrow \chi_{c1}(3872)K$

••• We do not use the following data for averages, fits, limits, etc. •••

seen 151 ⁵ BALA 15 BELL $B \rightarrow \chi_{c1}(3872)K\pi$

0.069 ± 0.022 ± 0.022 30 ⁶ AUBERT 05R BABR $B^+ \rightarrow K^+\pi^+\pi^-J/\psi$

0.074 ± 0.016 ± 0.023 36 ⁷ CHOI 03 BELL $B^+ \rightarrow K^+\pi^+\pi^-J/\psi$

¹ AAIJ 20S reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (7.95 \pm 0.15 \pm 0.33) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² CHOI 11 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (8.63 \pm 0.82 \pm 0.52) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ AUBERT 08Y reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (8.4 \pm 1.5 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ superseded by LEES 20C

⁵ BALA 15 reports $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi) \times B(B^0 \rightarrow \chi_{c1}(3872)K^+\pi^-) = (7.9 \pm 1.3 \pm 0.4) \times 10^{-6}$ and $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi) \times B(B^+ \rightarrow \chi_{c1}(3872)K^0\pi^+) = (10.6 \pm 3.0 \pm 0.9) \times 10^{-6}$.

⁶ Superseded by AUBERT 08Y. AUBERT 05R reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (1.28 \pm 0.41) \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁷ CHOI 03 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] / [B(B^+ \rightarrow \psi(2S)K^+)] / [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)] = 0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.24 \pm 0.21) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(\pi^+\pi^-\pi^0J/\psi(1S))/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	

not seen ¹ WANG 11B BELL $\Upsilon(2S) \rightarrow \gamma X$

not seen ² SHEN 10A BELL $\Upsilon(1S) \rightarrow \gamma X$

¹ WANG 11B reports $B(\Upsilon(2S) \rightarrow \gamma\chi_{c1}(3872)) \times B(\chi_{c1} \rightarrow \pi^+\pi^-\pi^0J/\psi) < 2.4 \times 10^{-6}$ at 95% CL.

² SHEN 10A reports $B(\Upsilon(1S) \rightarrow \gamma\chi_{c1}(3872)) \times B(\chi_{c1} \rightarrow \pi^+\pi^-\pi^0J/\psi) < 2.8 \times 10^{-6}$ at 95% CL.

NODE=M176235

NODE=M176R30
NODE=M176R30

OCCUR=2

NODE=M176R30;LINKAGE=A

NODE=M176R30;LINKAGE=E

NODE=M176R30;LINKAGE=D

NODE=M176R6
NODE=M176R6
NEW

SYCLP=A

SYCLP=A

SYCLP=A

SYCLP=A

NODE=M176R6;LINKAGE=E

NODE=M176R6;LINKAGE=F

NODE=M176R6;LINKAGE=AB

NODE=M176R6;LINKAGE=C

NODE=M176R6;LINKAGE=A

NODE=M176R6;LINKAGE=AE

NODE=M176R6;LINKAGE=CH

NODE=M176R25
NODE=M176R25

NODE=M176R25;LINKAGE=B

NODE=M176R25;LINKAGE=A

$\Gamma(\omega\eta_c(1S))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.4 (CL = 90%) [<0.30 (CL = 90%) OUR 2024 BEST LIMIT]**<0.4** 90 ¹ VINOKUROVA 15 BELL $B^+ \rightarrow \omega\eta_c K^+$

¹ VINOKUROVA 15 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega\eta_c(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 6.9 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 1.9 \times 10^{-4}$.

NODE=M176R24
NODE=M176R24

NODE=M176R24;LINKAGE=A

 $\Gamma(\rho(770)^0 J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_6/Γ_3

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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78.6±2.3±2.0 ¹ AAIJ 23S LHCb $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

¹ Assuming pure ρ contribution only, i.e. excluding the contribution from $\rho\omega$ interference. Using $B(\rho^0 \rightarrow \pi^+ \pi^-) = 100\%$.

NODE=M176R33
NODE=M176R33

NODE=M176R33;LINKAGE=A

 $\Gamma(\omega J/\psi(1S))/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.032±0.012±0.010 21±7 ¹ DEL-AMO-SA..10B BABR $B^+ \rightarrow \omega J/\psi K^+$

¹ DEL-AMO-SANCHEZ 10B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (6 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. DEL-AMO-SANCHEZ 10B also reports $B(B^0 \rightarrow \chi_{c1}(3872)K^0) \times B(\chi_{c1}(3872) \rightarrow J/\psi\omega) = (6 \pm 3 \pm 1) \times 10^{-6}$.

NODE=M176R14
NODE=M176R14

NODE=M176R14;LINKAGE=DE

 $\Gamma(\omega J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_7/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
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1.16±0.24 OUR AVERAGE Error includes scale factor of 1.2.1.24±0.33±0.10 ^{1,2} AAIJ 23S LHCb $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$ 1.6 $^{+0.4}_{-0.3}$ ±0.2 ³ ABLIKIM 19V BES $e^+ e^- \rightarrow \gamma\omega J/\psi$ 0.8 ±0.3 ⁴ DEL-AMO-SA..10B BABR $B \rightarrow \omega J/\psi K$

¹ AAIJ 23S reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega J/\psi(1S))/\Gamma(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S))] \times [B(\omega(782) \rightarrow \pi^+ \pi^-)] = (1.9 \pm 0.4 \pm 0.3) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^-) = (1.53 \pm 0.12) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Excluding $\rho\omega$ interference effects.³ Fit with fixed width and including two resonances, $\chi_{c0}(3915)$ and $X(3960)$.⁴ Statistical and systematic errors added in quadrature. Uses the values of $B(B \rightarrow \chi_{c1}(3872)K) \times B(\chi_{c1}(3872) \rightarrow J/\psi \pi^+ \pi^-)$ reported in AUBERT 08Y, taking into account the common systematics.NODE=M176R15
NODE=M176R15

OCCUR=3

NODE=M176R15;LINKAGE=G

NODE=M176R15;LINKAGE=H
NODE=M176R15;LINKAGE=A
NODE=M176R15;LINKAGE=DE $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen ¹ AAIJ 17BB LHCb pp at 7, 8 TeV

¹ AAIJ 17BB reports $B(b \rightarrow \chi_{c1}(3872)\text{anything}) \times B(\chi_{c1}(3872) \rightarrow \phi\phi) < 4.5 \times 10^{-7}$ at 95% CL.

NODE=M176R26
NODE=M176R26

NODE=M176R26;LINKAGE=A

 $\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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0.55±0.28 OUR AVERAGE [0.45 ± 0.21 OUR 2024 AVERAGE]**0.55 $^{+0.20}_{-0.23}$ ±0.17** 17 ¹ GOKHROO 06 BELL $B^+ \rightarrow D^0 \bar{D}^0 \pi^0 K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.32 90 ² CHISTOV 04 BELL Sup. by GOKHROO 06

¹ GOKHROO 06 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (1.02 \pm 0.31^{+0.21}_{-0.29}) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0 \bar{D}^0 \pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 0.6 \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 1.9 \times 10^{-4}$.

NODE=M176R12
NODE=M176R12

NEW

NODE=M176R12;LINKAGE=GO

NODE=M176R12;LINKAGE=A

 $\Gamma(D^0 \bar{D}^0 \pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_9/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.16 90 ABLIKIM 20W BES3 $e^+ e^- \rightarrow \gamma\chi_{c1}(3872)$ NODE=M176R17
NODE=M176R17

$$\Gamma(\bar{D}^{*0} D^0)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.46 ± 0.16 OUR AVERAGE

[0.34 ± 0.12 OUR 2024 AVERAGE]

0.52 ^{+0.13} _{-0.11} ± 0.16		1,2 HIRATA	23 BELL	e ⁺ e ⁻ → $\Upsilon(4S)$
0.42 ± 0.10 ± 0.13	41 ⁺⁹ ₋₈	3 AUSHEV	10 BELL	B ⁺ → D ^{*0} \bar{D}^0 K ⁺

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.90 ± 0.32 ± 0.28	27 ± 6	4 AUBERT	08B BABR	B ⁺ → $\bar{D}^{*0} D^0$ K ⁺
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¹HIRATA 23 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] = (0.97^{+0.21}_{-0.18} \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²Assumes equal production of B⁺ and B⁰ at the $\Upsilon(4S)$.

³AUSHEV 10 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] = (0.77 \pm 0.16 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴AUBERT 08B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] = (1.67 \pm 0.36 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (1.9 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$$\Gamma(\bar{D}^{*0} D^0)/\Gamma(\pi^+ \pi^- J/\psi(1S)) \quad \Gamma_{10}/\Gamma_3$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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11.77 ± 3.09 50 ABLIKIM 20W BES3 e⁺e⁻ → $\gamma \chi_{c1}(3872)$

$$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.13 (CL = 90%) [<0.10 (CL = 90%) OUR 2024 BEST LIMIT]

<0.13 90 ¹WICHT 08 BELL e⁺e⁻ → $\Upsilon(4S)$

¹WICHT 08 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 2.4 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.

$$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

<0.32 (CL = 90%) [<0.26 (CL = 90%) OUR 2024 BEST LIMIT]

<0.32 90 ¹CHISTOV 04 BELL B → K D⁰ \bar{D}^0

¹CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0 \bar{D}^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 6 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.

$$\Gamma(D^+ D^-)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.22 (CL = 90%) [<0.17 (CL = 90%) OUR 2024 BEST LIMIT]

<0.22 90 ¹CHISTOV 04 BELL B → K D⁺ D⁻

¹CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^+ D^-)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 4 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.

$$\Gamma(\pi^0 \chi_{c2})/\Gamma(\pi^+ \pi^- J/\psi(1S)) \quad \Gamma_{14}/\Gamma_3$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.1 90 ABLIKIM 19U BES3 e⁺e⁻ → $\gamma \chi_{c1}(3872)$

$$\Gamma(\pi^0 \chi_{c1})/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04 90 ¹BHARDWAJ 19 BELL B[±] → $\pi^0 \chi_{c1} K^\pm$

¹BHARDWAJ 19 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^0 \chi_{c1})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 8.1 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.

$$\Gamma(\pi^0 \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S)) \quad \Gamma_{15}/\Gamma_3$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
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88⁺³³₋₂₇ ± 10 10.8 ABLIKIM 19U BES3 e⁺e⁻ → $\gamma \chi_{c1}(3872)$

NODE=M176R13

NODE=M176R13

NEW

SYCLP=A

SYCLP=A

NODE=M176R13;LINKAGE=A

NODE=M176R13;LINKAGE=B

NODE=M176R13;LINKAGE=AS

NODE=M176R13;LINKAGE=AU

NODE=M176R16

NODE=M176R16

NODE=M176R09

NODE=M176R09

NODE=M176R09;LINKAGE=A

NODE=M176R3

NODE=M176R3

NODE=M176R3;LINKAGE=A

NODE=M176R4

NODE=M176R4

NODE=M176R4;LINKAGE=A

NODE=M176R06

NODE=M176R06

NODE=M176R23

NODE=M176R23

NODE=M176R23;LINKAGE=A

NODE=M176R05

NODE=M176R05

$\Gamma(\pi^0 \chi_{c0})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{16}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 3.6	90	ABLIKIM	22D BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<19	90	ABLIKIM	19U BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R04
 NODE=M176R04

 $\Gamma(\pi^+ \pi^- \eta_c(1S))/\Gamma_{total}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16 (CL = 90%)		[<0.13 (CL = 90%) OUR 2024 BEST LIMIT]		
<0.16	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow \pi^+ \pi^- \eta_c K^+$
¹ VINOKUROVA 15 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- \eta_c(1S))/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 3.0 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.				

NODE=M176R22
 NODE=M176R22

NODE=M176R22;LINKAGE=A

 $\Gamma(\pi^0 \pi^0 \chi_{c0})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{18}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	ABLIKIM	22D BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R28
 NODE=M176R28

 $\Gamma(\pi^0 \pi^0 \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{19}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ABLIKIM	24BU BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R37
 NODE=M176R37

 $\Gamma(\pi^0 \pi^0 \chi_{c2})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{20}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	ABLIKIM	24BU BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R38
 NODE=M176R38

 $\Gamma(\pi^+ \pi^- \chi_{c0})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{21}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.56	90	ABLIKIM	22D BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R29
 NODE=M176R29

 $\Gamma(\pi^+ \pi^- \chi_{c1})/\Gamma_{total}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8×10^{-3} (CL = 90%)		[< 7×10^{-3} (CL = 90%) OUR 2024 BEST LIMIT]		
< 8×10^{-3}	90	¹ BHARDWAJ 16	BELL	$B^+ \rightarrow \pi^+ \pi^- \chi_{c1} K^+$
¹ BHARDWAJ 16 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- \chi_{c1})/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 1.5 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.				

NODE=M176R00
 NODE=M176R00

NODE=M176R00;LINKAGE=A

 $\Gamma(\rho \bar{\rho})/\Gamma_{total}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.7×10^{-5} (CL = 95%)		[< 2.2×10^{-5} (CL = 95%) OUR 2024 BEST LIMIT]		
< 2.7×10^{-5}	95	¹ AAIJ	17AD LHCB	$B^+ \rightarrow \rho \bar{\rho} K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 9×10^{-5}	95	² AAIJ	13S LHCB	$B^+ \rightarrow \rho \bar{\rho} K^+$
¹ AAIJ 17AD reports $[\Gamma(\chi_{c1}(3872) \rightarrow \rho \bar{\rho})/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 0.5 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.				
² AAIJ 13S reports $[\Gamma(\chi_{c1}(3872) \rightarrow \rho \bar{\rho})/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 1.7 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 1.9 \times 10^{-4}$.				

NODE=M176R03
 NODE=M176R03

SYCLP=A

SYCLP=A

NODE=M176R03;LINKAGE=C

NODE=M176R03;LINKAGE=B

 $\Gamma(\pi^+ \pi^- \eta)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{24}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.12	90	ABLIKIM	24K BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R35
 NODE=M176R35

———— Radiative decays ————

NODE=M176410

 $\Gamma(\gamma D^+ D^-)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{25}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99	90	ABLIKIM	20W BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R20
 NODE=M176R20

 $\Gamma(\gamma \bar{D}^0 D^0)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{26}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.58	90	ABLIKIM	20W BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R21
 NODE=M176R21

$\Gamma(\gamma J/\psi)/\Gamma_{\text{total}}$					Γ_{27}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
10 ± 4 OUR AVERAGE	[(7.8 ± 2.9) × 10 ⁻³ OUR 2024 AVERAGE]				NEW
9.6^{+2.7}_{-2.5} ± 3.0	1	BHARDWAJ 11	BELL	$B^\pm \rightarrow \gamma J/\psi K^\pm$	SYCLP=A
• • • We do not use the following data for averages, fits, limits, etc. • • •					
15 ± 4 ± 5	20	² AUBERT	09B BABR	$B^+ \rightarrow \gamma J/\psi K^+$	SYCLP=A
18 ± 6 ± 6	19	³ AUBERT, BE	06M BABR	$B^+ \rightarrow \gamma J/\psi K^+$	SYCLP=A
¹ BHARDWAJ 11 reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] = (1.78 ^{+0.48} _{-0.44} ± 0.12) × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = (1.9 ± 0.6) × 10 ⁻⁴ . Our first error is their experiment's error and our second error is the systematic error from using our best value.					NODE=M176R7;LINKAGE=BA
² AUBERT 09B reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] = (2.8 ± 0.8 ± 0.1) × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = (1.9 ± 0.6) × 10 ⁻⁴ . Our first error is their experiment's error and our second error is the systematic error from using our best value.					NODE=M176R7;LINKAGE=AB
³ Superseded by AUBERT 09B. AUBERT, BE 06M reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] = (3.3 ± 1.0 ± 0.3) × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = (1.9 ± 0.6) × 10 ⁻⁴ . Our first error is their experiment's error and our second error is the systematic error from using our best value.					NODE=M176R7;LINKAGE=AU

$\Gamma(\gamma J/\psi)/\Gamma(\pi^+ \pi^- J/\psi(1S))$					Γ_{27}/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.52 ± 0.19 OUR AVERAGE	Error includes scale factor of 1.2. [0.79 ± 0.28 OUR 2024 AVERAGE]				NEW
0.38 ± 0.20 ± 0.01	8 ± 4	ABLIKIM 24X	BES3	$e^+ e^- \rightarrow \omega \chi_{c1}(3872)$	
0.79 ± 0.28		ABLIKIM 20W	BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$	

$\Gamma(\gamma \chi_{c1})/\Gamma_{\text{total}}$					Γ_{28}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 0.010 (CL = 90%)	[< 8 × 10 ⁻³ (CL = 90%) OUR 2024 BEST LIMIT]				
< 0.010	90	¹ BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$	
¹ BHARDWAJ 13 reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma \chi_{c1})/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] < 1.9 × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = 1.9 × 10 ⁻⁴ .					NODE=M176R08;LINKAGE=B

$\Gamma(\gamma \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S))$					Γ_{28}/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 0.89	90	CHOI 03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$	NODE=M176R1 NODE=M176R1

$\Gamma(\gamma \chi_{c2})/\Gamma_{\text{total}}$					Γ_{29}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 0.04 (CL = 90%)	[< 0.029 (CL = 90%) OUR 2024 BEST LIMIT]				
< 0.04	90	¹ BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c2} \gamma K^\pm$	
¹ BHARDWAJ 13 reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma \chi_{c2})/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] < 6.7 × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = 1.9 × 10 ⁻⁴ .					NODE=M176R01;LINKAGE=B

$\Gamma(\gamma \psi(2S))/\Gamma_{\text{total}}$					Γ_{30}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
possibly seen	36 ± 9	¹ AAIJ 14AH	LHCB	$B^+ \rightarrow \gamma \psi(2S) K^+$	NODE=M176R10 NODE=M176R10
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		² BHARDWAJ 11	BELL	$B^+ \rightarrow \gamma \psi(2S) K^+$	
0.051 ± 0.015 ± 0.016	25 ± 7	³ AUBERT 09B	BABR	$B^+ \rightarrow \gamma \psi(2S) K^+$	
¹ From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi \gamma$ decays with a statistical significance of 4.4σ.					NODE=M176R10;LINKAGE=A
² BHARDWAJ 11 reports B($B^+ \rightarrow K^+ \chi_{c1}(3872)$) × B($\chi_{c1} \rightarrow \gamma \psi(2S)$) < 3.45 × 10 ⁻⁶ at 90% CL.					NODE=M176R10;LINKAGE=BB
³ AUBERT 09B reports [$\Gamma(\chi_{c1}(3872) \rightarrow \gamma \psi(2S))/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \chi_{c1}(3872) K^+$)] = (9.5 ± 2.7 ± 0.6) × 10 ⁻⁶ which we divide by our best value B($B^+ \rightarrow \chi_{c1}(3872) K^+$) = (1.9 ± 0.6) × 10 ⁻⁴ . Our first error is their experiment's error and our second error is the systematic error from using our best value.					NODE=M176R10;LINKAGE=AA

$\Gamma(\gamma \psi(2S))/\Gamma(\pi^+ \pi^- J/\psi(1S))$					Γ_{30}/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 0.42	90	ABLIKIM 20W	BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$	NODE=M176R19 NODE=M176R19

$\Gamma(\pi^+\pi^-\chi_{c1})/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{22}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.18	90	ABLIKIM	24S BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R34
 NODE=M176R34

 $\Gamma(\gamma\psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{30}/Γ_{27}

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.67±0.25 OUR AVERAGE			[2.6 ± 0.6 OUR 2023 AVERAGE]		
1.67±0.21±0.13			¹ AAIJ	24AD LHCB	$B^+ \rightarrow \gamma\psi(2S)K^+$ and $\gamma J/\psi K^+$

NODE=M176R11
 NODE=M176R11
 NEW

••• We do not use the following data for averages, fits, limits, etc. •••

<0.59	90	ABLIKIM	20W BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
2.46±0.64±0.29	36 ± 9	² AAIJ	14AH LHCB	$B^+ \rightarrow \gamma\psi(2S)K^+$
<2.1	90	BHARDWAJ	11 BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$
3.4 ± 1.4		AUBERT	09B BABR	$B^+ \rightarrow \gamma c\bar{c}K'$

¹AAIJ 24AD reports this ratio as $1.67 \pm 0.21 \pm 0.12 \pm 0.04$ where the last uncertainty is due to the uncertainties of the branching fractions of $\psi(2S)$ and J/ψ mesons. We have added the last two uncertainties in quadrature.

NODE=M176R11;LINKAGE=C

²From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ . Superseded by AAIJ 24AD.

NODE=M176R11;LINKAGE=A

 $\Gamma(\gamma\psi_2(3823))/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{31}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.075	90	¹ ABLIKIM	24Z BES3	$e^+e^- \rightarrow \gamma\psi_2(3823)$

NODE=M176R36
 NODE=M176R36

¹Using $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = 0.343 \pm 0.010$. We have assumed that $B(\psi_2(3823) \rightarrow \gamma\chi_{c1}) = 1$.

NODE=M176R36;LINKAGE=A

C-violating decays $\Gamma(\eta J/\psi)/\Gamma_{total}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.021 (CL = 90%)		[<0.017 (CL = 90%) OUR 2024 BEST LIMIT]		
<0.021	90	^{1,2} IWASHITA	14 BELL	$B \rightarrow K\eta J/\psi$

NODE=M176R2
 NODE=M176R2

••• We do not use the following data for averages, fits, limits, etc. •••

<0.04	90	³ AUBERT	04Y BABR	$B \rightarrow K\eta J/\psi$
¹ IWASHITA 14 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \eta J/\psi)/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 3.8 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 1.9 \times 10^{-4}$.				
² IWASHITA 14 also scans the $\eta J/\psi$ mass range 3.8–4.75 GeV and sets upper limits for $B(B^\pm \rightarrow \chi_{c1}(3872)K^\pm) \times B(\chi_{c1}(3872) \rightarrow \eta J/\psi)$ in 5 MeV intervals.				
³ AUBERT 04Y reports $[\Gamma(\chi_{c1}(3872) \rightarrow \eta J/\psi)/\Gamma_{total}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 7.7 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 1.9 \times 10^{-4}$.				

NODE=M176R2;LINKAGE=A

NODE=M176R2;LINKAGE=C

NODE=M176R2;LINKAGE=D

 $\chi_{c1}(3872)$ REFERENCES

NODE=M176

AAIJ	24AD	JHEP 2411 121	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63038
ABLIKIM	24BU	PR D110 072015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63026
ABLIKIM	24C	PRL 132 151903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62652
ABLIKIM	24K	PR D109 L011102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62661
ABLIKIM	24S	PR D109 L071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62670
ABLIKIM	24X	PR D110 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62677
ABLIKIM	24Z	PR D110 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62679
AAIJ	23AP	JHEP 2307 084	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62412
AAIJ	23S	PR D108 L011103	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62287
ABLIKIM	23O	PR D107 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62058
ABLIKIM	23W	PRL 130 151904	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62068
HIRATA	23	PR D107 112011	H. Hirata <i>et al.</i>	(BELLE Collab.)	REFID=62281
YIN	23	PR D107 052004	J.H. Yin <i>et al.</i>	(BELLE Collab.)	REFID=61909
ABLIKIM	22D	PR D105 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61638
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
TERAMOTO	21	PRL 126 122001	Y. Teramoto <i>et al.</i>	(BELLE Collab.)	REFID=61098
AAIJ	20AD	PR D102 092005	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60673
AAIJ	20S	JHEP 2008 123	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60526
ABLIKIM	20W	PRL 124 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60570
LEES	20C	PRL 124 152001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=60554
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19U	PRL 122 202001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59786
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59796
BHARDWAJ	19	PR D99 111101	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=59884
AGHASYAN	18A	PL B783 334	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59036
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
BHARDWAJ	16	PR D93 052016	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=57272
AAIJ	15AO	PR D92 011102	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56771
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56787
BALA	15	PR D91 051101	A. Bala <i>et al.</i>	(BELLE Collab.)	REFID=56408
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
Also		JHEP 1702 088 (errata)	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=57795
AAIJ	14AH	NP B886 665	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55897
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55647

IWASHITA 14 PTEP 2014 043C01	T. Iwashita <i>et al.</i>	(BELLE Collab.)	REFID=55925
AAIJ 13Q PRL 110 222001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=54985
AAIJ 13S EPJ C73 2462	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55008
BHARDWAJ 13 PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=55412
AAIJ 12H EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
LEES 12AD PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54751
LEES 12AE PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
BHARDWAJ 11 PRL 107 091803	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=53779
CHOI 11 PR D84 052004	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=53934
WANG 11B PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=53939
AUSHEV 10 PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=53225
DEL-AMO-SA...10B PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53362
SHEN 10A PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AALTONEN 09AU PRL 103 152001	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=53098
AUBERT 09B PRL 102 132001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52722
AUBERT 08B PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
AUBERT 08Y PR D77 111101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52265
WICHT 08 PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
AUBERT 06 PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT_BE 06M PR D74 071101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51454
GOKHROO 06 PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)	REFID=51432
AUBERT 05B PR D71 031501	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50498
AUBERT 05D PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
AUBERT 05R PR D71 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50627
DOBBS 05 PRL 94 032004	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=50458
ABAZOV 04F PRL 93 162002	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=50200
ACOSTA 04 PRL 93 072001	D. Acosta <i>et al.</i>	(CDF Collab.)	REFID=49742
AUBERT 04Y PRL 93 041801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49997
CHISTOV 04 PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG 04 PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
YUAN 04 PL B579 74	C.Z. Yuan <i>et al.</i>		REFID=49677
CHOI 03 PRL 91 262001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=49628
BAI 98E PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
ANTONIAZZI 94 PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)	REFID=44074

NODE=M159

$\chi_{c0}(3915)$

$$J^{PC} = 0^{++}$$

was $X(3915)$

The $\chi_{c0}(3915)$ was originally seen by BELLE in its $\omega J/\psi$ decay mode and was produced in both B decays in CHOI 05 and $\gamma\gamma$ collisions in UEHARA 10. The J^{PC} was determined to be 0^{++} by BABAR in LEES 12AD but this assignment was questioned by ZHOU 15C. In AAIJ 20AI LHCb found the $D^+ D^-$ decay mode of the $\chi_{c0}(3915)$ using B decays and determined its J^{PC} to be 0^{++} . Based on their compatible mass, width, and J^{PC} , we assume the state decaying to $\omega J/\psi$ and the state decaying to $D^+ D^-$ are both the $\chi_{c0}(3915)$. See also the $\chi_{c2}(3930)$.

NODE=M159

$\chi_{c0}(3915)$ MASS

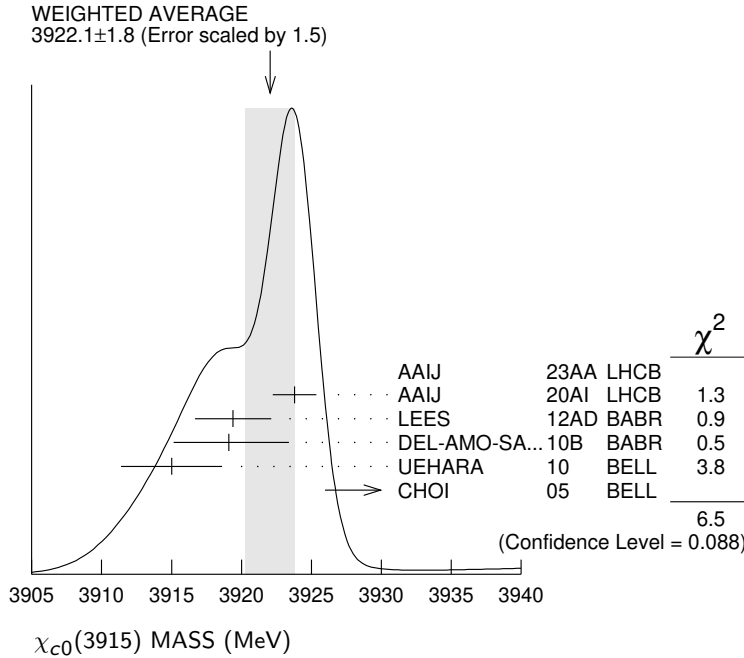
NODE=M159M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3922.1 ± 1.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
3956 ± 5 ± 10	360	¹ AAIJ	23AA LHCb	$B^+ \rightarrow D_s^+ D_s^- K^+$
3923.8 ± 1.5 ± 0.4	1.2k	² AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
3919.4 ± 2.2 ± 1.6	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
3919.1 ⁺ _{-3.4} ± 3.8 ± 2.0		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
3943 ± 11 ± 13	58 ± 11	³ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3920.9 ± 0.9		⁴ LI	24 RVUE	$\omega J/\psi$ invariant mass
3922.4 ± 6.5 ± 2.0		⁵ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$
3926.4 ± 2.2 ± 1.2		⁶ ABLIKIM	19v BES	$e^+ e^- \rightarrow \gamma\omega J/\psi$
3914.6 ⁺ _{-3.4} ± 3.8 ± 2.0		³ AUBERT	08w BABR	Superseded by DEL-AMO-SANCHEZ 10B

NODE=M159M

- ¹ $D_s^+ D_s^-$ near-threshold enhancement parameterized with a Flatte-like function .
- ² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape.
- ³ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.
- ⁴ From a simultaneous χ^2 fit to the distributions of the $\omega J/\psi$ invariant mass measured by BaBar and Belle in the processes $\gamma\gamma \rightarrow \omega J/\psi$ and $B \rightarrow \omega J/\psi K$. LHCb results also taken into account as an additional constraint in the χ^2 calculation.
- ⁵ Not distinguished from the $\chi_{c2}(3930)$.
- ⁶ Could also be $X(3940)$. Significance 3.1σ . Fit with additional resonance at 3963.7 ± 5.7 MeV, significance 3.4σ .

NODE=M159M;LINKAGE=D
 NODE=M159M;LINKAGE=B
 NODE=M159M;LINKAGE=CH
 NODE=M159M;LINKAGE=E
 NODE=M159M;LINKAGE=C
 NODE=M159M;LINKAGE=A



$\chi_{c0}(3915)$ WIDTH

NODE=M159W
 NODE=M159W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ± 4	OUR AVERAGE	Error includes scale factor of 1.1.		
43 ±13 ± 8	360	¹ AAIJ	23AA LHCB	$B^+ \rightarrow D_s^+ D_s^- K^+$
17.4 ± 5.1 ± 0.8	1.2k	² AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$
13 ± 6 ± 3	59	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
31 ⁺¹⁰ / ₋₈ ± 5		DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$
17 ±10 ± 3	49	UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
87 ±22 ±26	58	³ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
18.2 ± 2.4		⁴ LI	24 RVUE	$\omega J/\psi$ invariant mass
22 ±17 ± 4		⁵ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$
3.8 ± 7.5 ± 2.6		⁶ ABLIKIM	19V BES	$e^+ e^- \rightarrow \gamma\omega J/\psi$
34 ⁺¹² / ₋₈ ± 5		³ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

- ¹ $D_s^+ D_s^-$ near-threshold enhancement parameterized with a Flatte-like function .
- ² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape.
- ³ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.
- ⁴ From a simultaneous χ^2 fit to the distributions of the $\omega J/\psi$ invariant mass measured by BaBar and Belle in the processes $\gamma\gamma \rightarrow \omega J/\psi$ and $B \rightarrow \omega J/\psi K$. LHCb results also taken into account as an additional constraint in the χ^2 calculation.
- ⁵ Not distinguished from the $\chi_{c2}(3930)$.
- ⁶ Could also be $X(3940)$. Significance 3.1σ . Fit with additional resonance at 3963.7 ± 5.7 MeV, significance 3.4σ .

NODE=M159W;LINKAGE=D
 NODE=M159W;LINKAGE=B
 NODE=M159W;LINKAGE=CH
 NODE=M159W;LINKAGE=E
 NODE=M159W;LINKAGE=C
 NODE=M159W;LINKAGE=A

$\chi_{c0}(3915)$ DECAY MODES

NODE=M159215;NODE=M159

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	not seen
Γ_3 $D^+ D^-$	seen
Γ_4 $D_s^+ D_s^-$	seen
Γ_5 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_6 $\eta_c \eta$	not seen
Γ_7 $\eta_c \pi^0$	not seen
Γ_8 $K \bar{K}$	not seen
Γ_9 $\gamma \gamma$	seen
Γ_{10} $\gamma \psi(2S)$	not seen
Γ_{11} $\pi^0 \chi_{c1}$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=9
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=2
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=8

 $\chi_{c0}(3915)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M159220

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_9/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
54 ± 9 OUR AVERAGE					
52 ± 10 ± 3	59 ± 10	¹ LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
61 ± 17 ± 8	49 ± 15	¹ UEHARA	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
18 ± 5 ± 2	49 ± 15	² UEHARA	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
¹ For $J^P = 0^+$.					
² For $J^P = 2^+$, helicity-2.					

NODE=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UH
NODE=M159G01;LINKAGE=UR

$\Gamma(\gamma\psi(2S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{10}\Gamma_9/\Gamma$
VALUE (eV)		DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
9.8 ± 3.6 ± 1.3		¹ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$	
¹ Not distinguished from the $\chi_{c2}(3930)$.					

NODE=M159R07
NODE=M159R07

NODE=M159R07;LINKAGE=A

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_9/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<16	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$	

$\Gamma(K \bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_8\Gamma_9/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.96	90	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M159G02
NODE=M159G02

NODE=M159G03
NODE=M159G03

 $\chi_{c0}(3915)$ BRANCHING RATIOS

NODE=M159225

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT
seen		¹ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
seen		² CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
¹ DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow \chi_{c0}(3915) K^\pm) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega)$ $= (3.0^{+0.7+0.5}_{-0.6-0.3}) \times 10^{-5}$ and $B(B^0 \rightarrow \chi_{c0}(3915) K^0) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega)$ $= (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.				
² CHOI 05 reports $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.				

NODE=M159R03
NODE=M159R03

NODE=M159R03;LINKAGE=DE

NODE=M159R03;LINKAGE=CH

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0} D^0)$					Γ_1/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
>0.71	90	¹ AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$	
¹ By combining the upper limit $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow D^{*0} \bar{D}^0)$ $< 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.					

NODE=M159R02
NODE=M159R02

NODE=M159R02;LINKAGE=AU

$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE		DOCUMENT ID	TECN	COMMENT
seen		AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M159R06
NODE=M159R06

$\Gamma(D^+ D^-)/\Gamma(D_s^+ D_s^-)$ Γ_3/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
0.29±0.09±0.10±0.08	¹ AAIJ	23AA LHCB	$B^+ \rightarrow D_s^+ D_s^- K^+$

NODE=M159R08
 NODE=M159R08

¹ Assuming that AAIJ 20AI reporting on $B^+ \rightarrow D^+ D^- K^+$ also refers to $\chi_{c0}(3915)$.
 The last uncertainty is due to the values of $B(D^+ \rightarrow K^- \pi^+ \pi^+)$ and $B(D_s^+ \rightarrow K^- K^+ \pi^+)$ from PDG 22.

NODE=M159R08;LINKAGE=A

 $\Gamma(\eta_c \eta)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
not seen	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \eta$

NODE=M159R00
 NODE=M159R00

OCCUR=2

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)) \times B(\chi_{c0}(3915) \rightarrow \eta_c \eta) < 4.7 \times 10^{-5}$ at 90% CL.

NODE=M159R00;LINKAGE=A

 $\Gamma(\eta_c \pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
not seen	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^0$

NODE=M159R04
 NODE=M159R04

OCCUR=2

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)^0) \times B(\chi_{c0}(3915) \rightarrow \eta_c \pi^0) < 1.7 \times 10^{-5}$ at 90% CL.

NODE=M159R04;LINKAGE=A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
seen		UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$

NODE=M159R01
 NODE=M159R01

 $\Gamma(\pi^0 \chi_{c1})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	42 ± 14	¹ BHARDWAJ 19	BELL	$B^\pm \rightarrow \chi_{c1} \pi^0 K^\pm$

NODE=M159R05
 NODE=M159R05

¹ BHARDWAJ 19 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)) \times B(\chi_{c0}(3915) \rightarrow \chi_{c1} \pi^0) < 3.8 \times 10^{-5}$ at 90% CL. A signal significance 2.3 standard deviations.

NODE=M159R05;LINKAGE=A

 $\chi_{c0}(3915)$ REFERENCES

NODE=M159

LI	24	CP C48 063001	C. Li, X. Wang, C. Wu	(LNUDA)	REFID=62694
AAIJ	23AA	PRL 131 071901	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62314
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
WANG	22A	PR D105 112011	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=61640
AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.) JPC	REFID=60739
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59796
BHARDWAJ	19	PR D99 111101	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=59884
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
Also		JHEP 1702 088 (err.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)	REFID=57795
ZHOU	15C	PRL 115 022001	Z.-Y. Zhou, Z. Xiao, H.-Q. Zhou	(BEIJT, NANJ)	REFID=56842
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
LEES	12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54751
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
AUSHEV	10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=53225
DEL-AMO-SA...	10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53362
UEHARA	10	PRL 104 092001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53232
AUBERT	08W	PRL 101 082001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52263
CHOI	05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=50737

$\chi_{c2}(3930)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

NODE=M050

 $\chi_{c2}(3930)$ MASS

NODE=M050M

NODE=M050M

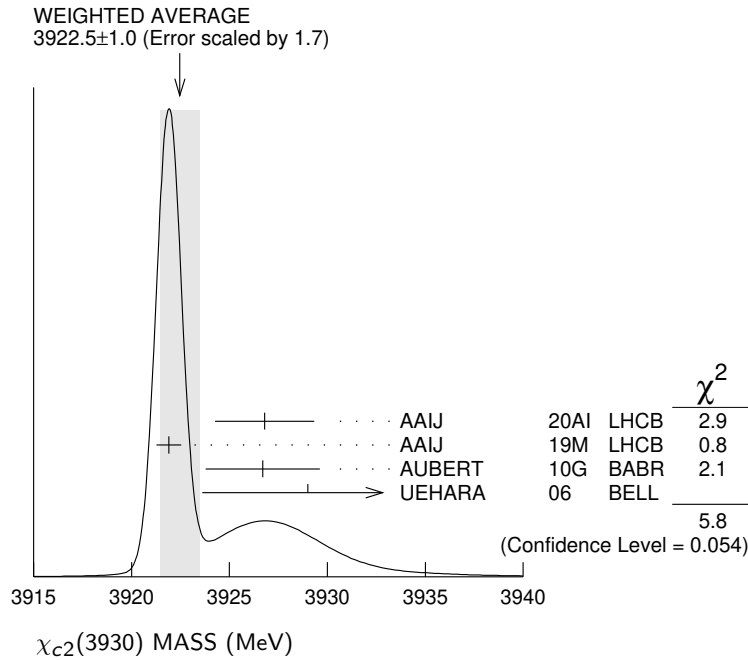
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3922.5±1.0 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
3926.8±2.4±0.8	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
3921.9±0.6±0.2		² AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
3926.7±2.7±1.1	76 ± 17	AUBERT	10G BABR	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$
3929 ± 5 ± 2	64	UEHARA	06 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Previous measurements assumed a single state in this region. This analysis revealed the presence of $\chi_{c0}(3930)$ with the same mass.

² Measured in prompt hadroproduction.

NODE=M050M;LINKAGE=B

NODE=M050M;LINKAGE=A

 **$\chi_{c2}(3930)$ WIDTH**

NODE=M050W

NODE=M050W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
35.2± 2.2 OUR AVERAGE		Error includes scale factor of 1.2.		
34.2± 6.6±1.1	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
36.6± 1.9±0.9		² AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
21.3± 6.8±3.6	76 ± 17	AUBERT	10G BABR	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$
29 ± 10 ± 2	64	UEHARA	06 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Previous measurements assumed a single state in this region. This analysis revealed the presence of $\chi_{c0}(3930)$ with the same mass.

² Measured in prompt hadroproduction.

NODE=M050W;LINKAGE=B

NODE=M050W;LINKAGE=A

 $\chi_{c2}(3930)$ DECAY MODES

NODE=M050215;NODE=M050

Mode	Fraction (Γ_i/Γ)
Γ_1 $\gamma\gamma$	seen
Γ_2 $K\bar{K}\pi$	not seen
Γ_3 $K^+ K^- \pi^+ \pi^- \pi^0$	not seen
Γ_4 $D\bar{D}$	seen
Γ_5 $D^+ D^-$	seen
Γ_6 $D^0 \bar{D}^0$	seen
Γ_7 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_8 $K\bar{K}$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

$\chi_{c2}(3930)$ PARTIAL WIDTHS

NODE=M050220

 $\chi_{c2}(3930) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M050222

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<2.1	90	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	

NODE=M050G01
NODE=M050G01

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<3.4	90	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	

NODE=M050G02
NODE=M050G02

$\Gamma(D\bar{D}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_1/\Gamma$
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.21±0.04 OUR AVERAGE					

NODE=M050G1
NODE=M050G1

0.24±0.05±0.04	76 ± 17	AUBERT	10G	BABR	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$
0.18±0.05±0.03	64	¹ UEHARA	06	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

¹ Assuming $B(D^+ D^-) = 0.89 B(D^0 \bar{D}^0)$.

NODE=M050G1;LINKAGE=UE

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_7\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<18	90	LEES	12AE	BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M050G03
NODE=M050G03

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_8\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.256	90	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M050G04
NODE=M050G04 $\chi_{c2}(3930)$ BRANCHING RATIOS

NODE=M050225

$\Gamma(D^+ D^-)/\Gamma(D^0 \bar{D}^0)$					Γ_5/Γ_6
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.74±0.43±0.16	64	UEHARA	06	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- D\bar{D}$

NODE=M050R01
NODE=M050R01 $\chi_{c2}(3930)$ REFERENCES

NODE=M050

AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60739
AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59697
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
DEL-AMO-SA...11M	PR D84	012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
AUBERT	10G	PR D81 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53357
UEHARA	06	PRL 96 082003	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=51039

X(3940)

$$I^G(J^{PC}) = ?^?(?^{??})$$

OMITTED FROM SUMMARY TABLE

Reported by ABE 07, observed in $e^+e^- \rightarrow J/\psi X$.

NODE=M029

NODE=M029

NODE=M029M

NODE=M029M

X(3940) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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3942 \pm 9 OUR AVERAGE

3945 $^{+28+37}_{-17-28}$	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*\pm} D^\mp K^+$
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3942 $^{+7}_{-6} \pm 6$	52	PAKHLOV	08 BELL	$e^+e^- \rightarrow J/\psi X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3943 $\pm 6 \pm 6$	25	² ABE	07 BELL	$e^+e^- \rightarrow J/\psi X$
--------------------	----	------------------	---------	-------------------------------

3936 ± 14	266	³ ABE	07 BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$
---------------	-----	------------------	---------	---------------------------------------

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

² From a fit to $D^{*+} D^-$ and $D^{*0} \bar{D}^0$ events.

³ From the inclusive fit. Not independent of the exclusive measurement by ABE 07.

OCCUR=2

NODE=M029M;LINKAGE=A

NODE=M029M;LINKAGE=EB

NODE=M029M;LINKAGE=EM

X(3940) WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	-----	------	-------------	------	---------

43 $^{+28}_{-18}$ OUR AVERAGE Error includes scale factor of 1.1. [37 $^{+27}_{-17}$ MeV OUR 2024 AVERAGE]

130 $^{+92+101}_{-49-70}$	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*\pm} D^\mp K^+$
---------------------------	------	-------------------	-----------	--------------------------------------

37 $^{+26}_{-15} \pm 8$	52	PAKHLOV	08 BELL	$e^+e^- \rightarrow J/\psi X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 52	90	25	ABE	07 BELL	$e^+e^- \rightarrow J/\psi X$
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¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M029W

NODE=M029W

NEW

NODE=M029W;LINKAGE=A

X(3940) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}^* + c.c.$	seen
Γ_2 $D\bar{D}$	not seen
Γ_3 $J/\psi\omega$	not seen

NODE=M029215;NODE=M029

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

X(3940) BRANCHING RATIOS

$\Gamma(D\bar{D}^* + c.c.)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
-------	-----	------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.45	90	25	^{1,2} ABE	07 BELL	$e^+e^- \rightarrow J/\psi X$
-------	----	----	--------------------	---------	-------------------------------

¹ For X(3940) decaying to final states with more than two tracks.

² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029225

NODE=M029R01

NODE=M029R01

NODE=M029R01;LINKAGE=AB

NODE=M029R01;LINKAGE=AE

$\Gamma(D\bar{D})/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.41	90	^{1,2} ABE	07 BELL	$e^+e^- \rightarrow J/\psi X$
-------	----	--------------------	---------	-------------------------------

¹ For X(3940) decaying to final states with more than two tracks.

² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029R02

NODE=M029R02

NODE=M029R02;LINKAGE=AB

NODE=M029R02;LINKAGE=AE

$\Gamma(J/\psi\omega)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
-------	-----	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.26	90	1,2 ABE	07 BELL	$e^+e^- \rightarrow J/\psi X$
-------	----	---------	---------	-------------------------------

¹ For $X(3940)$ decaying to final states with more than two tracks.

² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c² may consist of several states.

NODE=M029R03
NODE=M029R03

NODE=M029R03;LINKAGE=AB
NODE=M029R03;LINKAGE=AE

X(3940) REFERENCES

AAJ	24AB	PRL 133 131902	R. Aaij <i>et al.</i>	(LHCb Collab.)
PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M029

REFID=63014
REFID=52302
REFID=51627

NODE=M072

$\psi(4040)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\psi(4040)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

4039.6 ± 4.3	¹ ABLIKIM	08D	BES2 $e^+e^- \rightarrow$ hadrons
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4034 ± 6	² MO	10	RVUE $e^+e^- \rightarrow$ hadrons
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4037 ± 2	³ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
----------	-------------------	-----	-----------------------------------

4040 ± 1	⁴ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
----------	-------------------	-----	-----------------------------------

4040 ± 10	BRANDELIK	78C	DASP e^+e^-
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¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

NODE=M072M

NODE=M072M

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST

NODE=M072M;LINKAGE=SE

 $\psi(4040)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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84.5 ± 12.3	⁵ ABLIKIM	08D	BES2 $e^+e^- \rightarrow$ hadrons
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• • • We do not use the following data for averages, fits, limits, etc. • • •

87 ± 11	⁶ MO	10	RVUE $e^+e^- \rightarrow$ hadrons
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85 ± 10	⁷ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
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89 ± 6	⁸ SETH	05A	RVUE $e^+e^- \rightarrow$ hadrons
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52 ± 10	BRANDELIK	78C	DASP e^+e^-
---------	-----------	-----	---------------

⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

⁷ From a fit to Crystal Ball (OSTERHELD 86) data.

⁸ From a fit to BES (BAI 02C) data.

NODE=M072W

NODE=M072W

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST

NODE=M072W;LINKAGE=SE

 $\psi(4040)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more

NODE=M072215;NODE=M072

NODE=M072

(less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^+ e^-$	$(1.02 \pm 0.17) \times 10^{-5}$	DESIG=5
Γ_2 $D\bar{D}$	seen	DESIG=17;OUR EST;→ UNCHECKED ←
Γ_3 $D^0\bar{D}^0$	seen	DESIG=1
Γ_4 $D^+ D^-$	seen	DESIG=18
Γ_5 $D^*\bar{D} + c.c.$	seen	DESIG=19;OUR EST;→ UNCHECKED ←
Γ_6 $D^*(2007)^0\bar{D}^0 + c.c.$	seen	DESIG=2
Γ_7 $D^*(2010)^+ D^- + c.c.$	seen	DESIG=20
Γ_8 $D^*\bar{D}^*$	seen	DESIG=21;OUR EST;→ UNCHECKED ←
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	DESIG=3
Γ_{10} $D^*(2010)^+ D^*(2010)^-$	seen	DESIG=22
Γ_{11} $D\bar{D}\pi$ (excl. $D^*\bar{D}^*$)	not seen	DESIG=23;OUR EST;→ UNCHECKED ←
Γ_{12} $D^0 D^- \pi^+ + c.c.$ (excl. $D^*(2010)^+ D^- + c.c.$)	not seen	DESIG=24
Γ_{13} $D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	DESIG=25
Γ_{14} $D^0\bar{D}^{*-}\pi^+ + c.c.$ (excl. $D^*(2010)^+ D^*(2010)^-$)	seen	DESIG=26
Γ_{15} $D_s^+ D_s^-$	seen	DESIG=27
Γ_{16} $\pi^+ \pi^+ \pi^- \pi^- \pi^0$	seen	DESIG=37;OUR EST;→ UNCHECKED ←
Γ_{17} $J/\psi(1S)$ hadrons	seen	DESIG=4;OUR EST;→ UNCHECKED ←
Γ_{18} $J/\psi \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90% DESIG=7
Γ_{19} $J/\psi \pi^0 \pi^0$	$< 2 \times 10^{-3}$	90% DESIG=8
Γ_{20} $J/\psi \eta$	$(5.2 \pm 0.7) \times 10^{-3}$	DESIG=9
Γ_{21} $J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	90% DESIG=10
Γ_{22} $J/\psi \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	90% DESIG=11
Γ_{23} $\chi_{c1} \gamma$	$< 3.4 \times 10^{-3}$	90% DESIG=12
Γ_{24} $\chi_{c2} \gamma$	$< 5 \times 10^{-3}$	90% DESIG=13
Γ_{25} $\chi_{c1} \pi^+ \pi^- \pi^0$	$< 1.1 \%$	90% DESIG=14
Γ_{26} $\chi_{c2} \pi^+ \pi^- \pi^0$	$< 3.2 \%$	90% DESIG=15
Γ_{27} $h_c(1P) \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90% DESIG=28
Γ_{28} $\phi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90% DESIG=16
Γ_{29} $\Lambda \bar{\Lambda} \pi^+ \pi^-$	$< 2.9 \times 10^{-4}$	90% DESIG=29
Γ_{30} $\Lambda \bar{\Lambda} \pi^0$	$< 9 \times 10^{-5}$	90% DESIG=30
Γ_{31} $\Lambda \bar{\Lambda} \eta$	$< 3.0 \times 10^{-4}$	90% DESIG=31
Γ_{32} $\Lambda \bar{\Lambda}$	$< 6 \times 10^{-6}$	90% DESIG=36
Γ_{33} $\Sigma^+ \bar{\Sigma}^-$	$< 1.3 \times 10^{-4}$	90% DESIG=32
Γ_{34} $\Sigma^0 \bar{\Sigma}^0$	$< 7 \times 10^{-5}$	90% DESIG=33
Γ_{35} $\Xi^+ \bar{\Xi}^-$	$< 1.6 \times 10^{-4}$	90% DESIG=34
Γ_{36} $\Xi^0 \bar{\Xi}^0$	$< 1.8 \times 10^{-4}$	90% DESIG=35
Γ_{37} $\Xi^- \bar{\Xi}^+$	$< 6 \times 10^{-5}$	90% DESIG=38
Γ_{38} $\Lambda \bar{\Xi}^+ K^- + c.c.$	$< 7 \times 10^{-5}$	90% DESIG=39
Γ_{39} $\Sigma^0 \bar{\Xi}^+ K^- + c.c.$	$< 1.5 \times 10^{-5}$	90% DESIG=40
Γ_{40} $\mu^+ \mu^-$	$(9 \pm 6) \times 10^{-6}$	DESIG=6

$\psi(4040)$ PARTIAL WIDTHS

NODE=M072220

$\Gamma(e^+ e^-)$

Γ_1

VALUE (keV)

DOCUMENT ID TECN COMMENT

0.86±0.07 OUR ESTIMATE

0.83±0.20

⁹ ABLIKIM 08D BES2 $e^+ e^- \rightarrow$ hadrons

••• We do not use the following data for averages, fits, limits, etc. •••

0.6 to 1.4 ¹⁰ MO 10 RVUE $e^+ e^- \rightarrow$ hadrons

0.88±0.11 ¹¹ SETH 05A RVUE $e^+ e^- \rightarrow$ hadrons

0.91±0.13 ¹² SETH 05A RVUE $e^+ e^- \rightarrow$ hadrons

0.75±0.15 BRANDELIK 78C DASP $e^+ e^-$

NODE=M072W5

NODE=M072W5

→ UNCHECKED ←

OCCUR=2

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

¹² From a fit to BES (BAI 02C) data.

NODE=M072W5;LINKAGE=AB

NODE=M072W5;LINKAGE=MO

NODE=M072W5;LINKAGE=ST

NODE=M072W5;LINKAGE=SE

$\Gamma(\mu^+\mu^-)$

Γ_{40}

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.73±0.48±0.12	13,14 ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M072W2
NODE=M072W2

¹³ From a fit to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+\mu^-) = \Gamma(e^+e^-)$.

NODE=M072W2;LINKAGE=A

¹⁴ From solution 1 of 8 with equal fit quality. Other solutions range from $0.58 \pm 0.52 \pm 0.10$ to $0.80 \pm 0.48 \pm 0.13$ keV.

NODE=M072W2;LINKAGE=B

$\psi(4040) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M072235

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{20}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M072R00
NODE=M072R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.0±0.2±0.1	¹⁵ ABLIKIM	24T	BES3	$e^+e^- \rightarrow \eta J/\psi$
7.1±0.6±0.9	¹⁶ ABLIKIM	24T	BES3	$e^+e^- \rightarrow \eta J/\psi$
1.1±0.2±0.2	¹⁷ ABLIKIM	24T	BES3	$e^+e^- \rightarrow \eta J/\psi$
7.8±0.6±1.1	¹⁸ ABLIKIM	24T	BES3	$e^+e^- \rightarrow \eta J/\psi$
1.5±0.3	¹⁹ ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$
1.4±0.3	²⁰ ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$
7.0±0.6	²¹ ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=3

¹⁵ Solution 1 of 4. Supersedes ABLIKIM 200.

¹⁶ Solution 2 of 4. Supersedes ABLIKIM 200.

¹⁷ Solution 3 of 4. Supersedes ABLIKIM 200.

¹⁸ Solution 4 of 4. Supersedes ABLIKIM 200.

¹⁹ Solution 1 of three equivalent fit solutions using three resonant structures.

²⁰ Solution 2 of three equivalent fit solutions using three resonant structures.

²¹ Solution 3 of three equivalent fit solutions using three resonant structures.

NODE=M072R00;LINKAGE=D

NODE=M072R00;LINKAGE=E

NODE=M072R00;LINKAGE=F

NODE=M072R00;LINKAGE=G

NODE=M072R00;LINKAGE=A

NODE=M072R00;LINKAGE=B

NODE=M072R00;LINKAGE=C

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{23}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	²² HAN	15	BELL 10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

NODE=M072G01
NODE=M072G01

²² Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M072G01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{24}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	²³ HAN	15	BELL 10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M072G02
NODE=M072G02

²³ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M072G02;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{32}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.5 × 10⁻³	90	²⁴ ABLIKIM	21AS BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R33
NODE=M072R33

²⁴ From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M072R33;LINKAGE=A

$\Gamma(\Sigma^+\bar{\Sigma}^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{33}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<216.6 × 10⁻³	90	²⁵ ABLIKIM	24AH BES3	$e^+e^- \rightarrow \Sigma^+\bar{\Sigma}^-$

NODE=M072R37
NODE=M072R37

²⁵ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M072R37;LINKAGE=A

$\Gamma(\Xi^0\bar{\Xi}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_{36}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<83.4 × 10⁻³	90	²⁶ ABLIKIM	24CD BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R40
NODE=M072R40

²⁶ From a fit to $e^+e^- \rightarrow \Xi^0\bar{\Xi}^0$ cross sections.

NODE=M072R40;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{37} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<51.9 × 10⁻³ (CL = 90%) [<0.0519 eV (CL = 90%) OUR 2024 BEST LIMIT]

<51.9 × 10⁻³ 90 27 ABLIKIM 23BK BES3 e⁺e⁻ → ψ(4040)

²⁷ From a fit to e⁺e⁻ → Ξ⁻Ξ⁺ cross sections.

NODE=M072R35
NODE=M072R35

NODE=M072R35;LINKAGE=A

$$\Gamma(\Lambda \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{38} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<62.0 × 10⁻³ 90 28 ABLIKIM 24AL BES3 e⁺e⁻ → ΛΞ⁺K⁻ + c.c.

²⁸ A fit to the Born cross section of e⁺e⁻ → ΛΞ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M072R38
NODE=M072R38

NODE=M072R38;LINKAGE=A

$$\Gamma(\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{39} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
------------	-----	-------------	------	---------

<12.5 × 10⁻³ 90 29 ABLIKIM 24AL BES3 e⁺e⁻ → Σ⁰Ξ⁺K⁻ + c.c.

²⁹ A fit to the Born cross section of e⁺e⁻ → Σ⁰Ξ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M072R39
NODE=M072R39

NODE=M072R39;LINKAGE=A

$$\psi(4040) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$$

NODE=M072230

$$\Gamma(J/\psi\eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{20} / \Gamma \times \Gamma_1 / \Gamma$$

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

5.1 ± 1.4 ± 1.5 30 WANG 13B BELL e⁺e⁻ → J/ψηγ

12.8 ± 2.1 ± 1.9 31 WANG 13B BELL e⁺e⁻ → J/ψηγ

³⁰ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

³¹ Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

NODE=M072R25
NODE=M072R25

OCCUR=2

NODE=M072R25;LINKAGE=A

NODE=M072R25;LINKAGE=B

ψ(4040) BRANCHING RATIOS

NODE=M072225

$$\Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma$$

VALUE (units 10 ⁻⁵)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 1.0 FELDMAN 77 MRK1 e⁺e⁻

NODE=M072R4
NODE=M072R4

$$\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

seen 32 ABLIKIM 24BH BES3 e⁺e⁻ → D⁰̄D⁰

seen AUBERT 09M BABR e⁺e⁻ → D⁰̄D⁰γ

seen CRONIN-HEN..09 CLEO e⁺e⁻ → D⁰̄D⁰

seen PAKHLOVA 08 BELL e⁺e⁻ → D⁰̄D⁰γ

³² A precision measurement of the e⁺e⁻ → D⁰̄D⁰ cross section shows complex structure in this mass region.

NODE=M072R14
NODE=M072R14

NODE=M072R14;LINKAGE=A

$$\Gamma(D^+ D^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen 33 ABLIKIM 24BH BES3 e⁺e⁻ → D⁺D⁻

seen AUBERT 09M BABR e⁺e⁻ → D⁺D⁻γ

seen CRONIN-HEN..09 CLEO e⁺e⁻ → D⁺D⁻

seen PAKHLOVA 08 BELL e⁺e⁻ → D⁺D⁻γ

³³ A precision measurement of the e⁺e⁻ → D⁺D⁻ cross section shows complex structure in this mass region.

NODE=M072R15
NODE=M072R15

NODE=M072R15;LINKAGE=A

$$\Gamma(D \bar{D}) / \Gamma(D^* \bar{D} + \text{c.c.}) \quad \Gamma_2 / \Gamma_5$$

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.24 ± 0.05 ± 0.12 AUBERT 09M BABR e⁺e⁻ → γD^(*)̄D

NODE=M072R12
NODE=M072R12

$$\Gamma(D^0 \bar{D}^0) / \Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.}) \quad \Gamma_3 / \Gamma_6$$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.05 ± 0.03 34 GOLDHABER 77 MRK1 e⁺e⁻

³⁴ Phase-space factor (p³) explicitly removed.

NODE=M072R1
NODE=M072R1

NODE=M072R;LINKAGE=P

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

NODE=M072R16
NODE=M072R16

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	³⁵ ZHUKOVA	18 BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$

NODE=M072R17
NODE=M072R17
OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
-------------	----------	---------	---

³⁵ Supersedes PAKHLOVA 07.

NODE=M072R17;LINKAGE=C

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$$

 Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.95 ± 0.09 ± 0.10	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^* \bar{D}$

NODE=M072R11
NODE=M072R11

$$\Gamma(D^* \bar{D}^*)/\Gamma(D^* \bar{D} + \text{c.c.})$$

 Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
0.18 ± 0.14 ± 0.03	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M072R13
NODE=M072R13

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$

NODE=M072R18
NODE=M072R18

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$$

 Γ_9/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
32.0 ± 12.0	³⁶ GOLDHABER	77 MRK1	$e^+ e^-$

NODE=M072R2
NODE=M072R2

³⁶ Phase-space factor (p^3) explicitly removed.

NODE=M072R2;LINKAGE=P

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	³⁷ ZHUKOVA	18 BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$

NODE=M072R19
NODE=M072R19
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA	07 BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
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³⁷ Supersedes PAKHLOVA 07.

NODE=M072R19;LINKAGE=B

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	08A BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M072R20
NODE=M072R20

$$\Gamma(D \bar{D}^* \pi (\text{excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M072R21
NODE=M072R21

$$\Gamma(D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$$

 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	09 BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M072R22
NODE=M072R22

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11 BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

NODE=M072R23
NODE=M072R23

$\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$(3.51 \pm 1.89 \pm 1.24) \times 10^{-5}$	³⁸ ABLIKIM	21AWBES3	$e^+e^- \rightarrow 2\pi^+2\pi^-\pi^0$
$(2.41 \pm 0.05 \pm 0.79) \times 10^{-2}$	³⁹ ABLIKIM	21AWBES3	$e^+e^- \rightarrow 2\pi^+2\pi^-\pi^0$

³⁸ Solution 1 of two solutions with equal fit quality. The significance of the $\psi(4040)$ signal is 3.6σ .

³⁹ Solution 2 of two solutions with equal fit quality. The significance of the $\psi(4040)$ signal is 3.6σ .

Γ₁₆/Γ
NODE=M072R34
NODE=M072R34

OCCUR=2

NODE=M072R34;LINKAGE=A

NODE=M072R34;LINKAGE=B

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<4	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
----	----	------	----	---

Γ₁₈/Γ
NODE=M072R01
NODE=M072R01

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<2	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
----	----	------	----	---

Γ₁₉/Γ
NODE=M072R02
NODE=M072R02

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

5.2 ± 0.5 ± 0.5		⁴⁰ ABLIKIM	12K	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
----	----	------	----	---

⁴⁰ ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\eta) = 32.1 \pm 2.8 \pm 1.3$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays. Also see ABLIKIM 24T.

Γ₂₀/Γ
NODE=M072R03
NODE=M072R03

NODE=M072R03;LINKAGE=AB

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<0.28	90	⁴¹ ABLIKIM	12K	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<2	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
----	----	------	----	---

⁴¹ ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\pi^0) < 1.6$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

Γ₂₁/Γ
NODE=M072R04
NODE=M072R04

NODE=M072R04;LINKAGE=AB

 $\Gamma(J/\psi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<2	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
----	----	------	----	---

Γ₂₂/Γ
NODE=M072R05
NODE=M072R05

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<11	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
-----	----	------	----	---

• • • We do not use the following data for averages, fits, limits, etc. • • •

Γ₂₃/Γ
NODE=M072R06
NODE=M072R06

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<17	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
-----	----	------	----	---

• • • We do not use the following data for averages, fits, limits, etc. • • •

Γ₂₄/Γ
NODE=M072R07
NODE=M072R07

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<11	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
-----	----	------	----	---

Γ₂₅/Γ
NODE=M072R08
NODE=M072R08

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<32	90	COAN	06	CLEO 3.97-4.06 $e^+e^- \rightarrow$ hadrons
-----	----	------	----	---

Γ₂₆/Γ
NODE=M072R09
NODE=M072R09

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
--------------------------	-----	-------------	------	---------

<3	90	⁴² PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$
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Γ₂₇/Γ
NODE=M072R24
NODE=M072R24

⁴² From several values of \sqrt{s} near the peak of the $\psi(4040)$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 1.0 \pm 8.0 \pm 5.4 \pm 0.2$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M072R24;LINKAGE=PE

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{28}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<3	90	COAN	06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R10
NODE=M072R10

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{29}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<2.9	90	43 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R26
NODE=M072R26

⁴³ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R26;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$					Γ_{30}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.9	90	44 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R27
NODE=M072R27

⁴⁴ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R27;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$					Γ_{31}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<3.0	90	45 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R28
NODE=M072R28

⁴⁵ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R28;LINKAGE=A

$\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$					Γ_{33}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.3	90	46 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R29
NODE=M072R29

⁴⁶ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R29;LINKAGE=A

$\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$					Γ_{34}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.7	90	47 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R30
NODE=M072R30

⁴⁷ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R30;LINKAGE=A

$\Gamma(\Xi^+\bar{\Xi}^-)/\Gamma_{\text{total}}$					Γ_{35}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.6	90	48 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R31
NODE=M072R31

⁴⁸ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R31;LINKAGE=A

$\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$					Γ_{36}/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.8	90	49 ABLIKIM	13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

NODE=M072R32
NODE=M072R32

⁴⁹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R32;LINKAGE=A

$\psi(4040)$ REFERENCES

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	24BH	PRL 133 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	24T	PR D109 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AW	PR D104 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
ABLIKIM	13Q	PR D87 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	12K	PR D86 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIC	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
Also		ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
GOLDBABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)

NODE=M072

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REFID=22062
REFID=11434

NODE=M193

$\chi_{c1}(4140)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

was $X(4140)$

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M193

Seen by AALTONEN 09AH, ABAZOV 14A, CHATRCHYAN 14M, AAIJ 17C in $B^+ \rightarrow \chi_{c1} K^+$, $\chi_{c1} \rightarrow J/\psi \phi$, and by ABAZOV 15M separately in both prompt (4.7σ) and non-prompt (5.6σ) production in $p\bar{p} \rightarrow J/\psi \phi + \text{anything}$. Not seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi \phi$ and ABLIKIM 15 in $e^+e^- \rightarrow \gamma J/\psi \phi$ at $\sqrt{s} = 4.23, 4.26, 4.36$ GeV.

$\chi_{c1}(4140)$ MASS

NODE=M193M

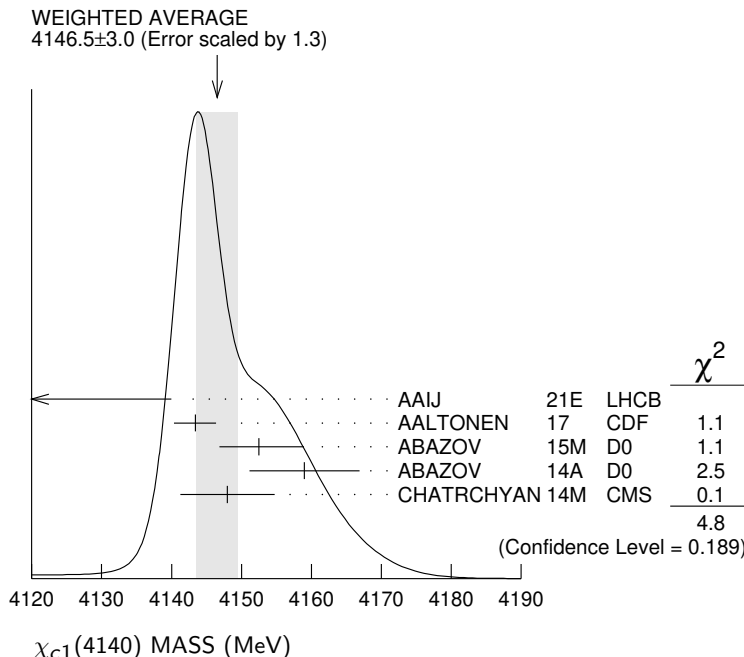
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4146.5 ± 3.0 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
4118 ± 11 ⁺¹⁹ ₋₃₆	24k	1 AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4143.4 ^{+2.9} _{-3.0} ± 0.6	19	2 AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
4152.5 ± 1.7 ^{+6.2} _{-5.4}	616	3 ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
4159.0 ± 4.3 ± 6.6	52	4 ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
4148.0 ± 2.4 ± 6.3	0.3k	5 CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi \phi K^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4146.5 ± 4.5 ^{+4.6} _{-2.8}	4289	6,7 AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4143.0 ± 2.9 ± 1.2	14	8,9 AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M193M

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13σ .
- ² Statistical significance of more than 5σ .
- ³ Statistical significance of more than 6σ .
- ⁴ Statistical significance of 3.1σ .
- ⁵ From a fit assuming an S -wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5σ .
- ⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4σ .
- ⁷ Superseded by AAIJ 21E.
- ⁸ Statistical significance of 3.8σ .
- ⁹ Superseded by AALTONEN 17.

NODE=M193M;LINKAGE=G
 NODE=M193M;LINKAGE=E
 NODE=M193M;LINKAGE=C
 NODE=M193M;LINKAGE=A
 NODE=M193M;LINKAGE=B

NODE=M193M;LINKAGE=D
 NODE=M193M;LINKAGE=H
 NODE=M193M;LINKAGE=AA
 NODE=M193M;LINKAGE=F



$\chi_{c1}(4140)$ WIDTH

NODE=M193W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
19	$\pm \frac{7}{5}$	OUR AVERAGE		
162	± 21	24k	1	AAIJ 21E LHCB $B^+ \rightarrow J/\psi \phi K^+$
15.3	± 10.4	19	2	AALTONEN 17 CDF $B^+ \rightarrow J/\psi \phi K^+$
16.3	± 5.6	616	3	ABAZOV 15M D0 $p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
20	± 13	52	4	ABAZOV 14A D0 $B^+ \rightarrow J/\psi \phi K^+$
28	± 15	0.3k	5	CHATRCHYAN 14M CMS $B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
83	± 21	4289	6,7	AAIJ 17C LHCB $B^+ \rightarrow J/\psi \phi K^+$
11.7	± 8.3	14	8,9	AALTONEN 09AH CDF $B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13 σ . ² Statistical significance of more than 5 σ . ³ Statistical significance of more than 6 σ . ⁴ Statistical significance of 3.1 σ . ⁵ From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 σ . ⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4 σ . ⁷ Superseded by AAIJ 21E. ⁸ Statistical significance of 3.8 σ . ⁹ Superseded by AALTONEN 17.				

NODE=M193W

NODE=M193W;LINKAGE=G
 NODE=M193W;LINKAGE=E
 NODE=M193W;LINKAGE=C
 NODE=M193W;LINKAGE=A
 NODE=M193W;LINKAGE=B

NODE=M193W;LINKAGE=D
 NODE=M193W;LINKAGE=H
 NODE=M193W;LINKAGE=AA
 NODE=M193W;LINKAGE=F

 $\chi_{c1}(4140)$ DECAY MODES

NODE=M193215;NODE=M193

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

 $\chi_{c1}(4140)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M193220

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_2\Gamma_1/\Gamma$
<41	90	1	SHEN 10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi \phi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6	90	2	SHEN 10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi \phi$	
¹ For $J^P = 0^+$. ² For $J^P = 2^+$.					

NODE=M193G01
 NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
 NODE=M193G01;LINKAGE=S2

 $\chi_{c1}(4140)$ BRANCHING RATIOS

NODE=M193225

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	24k	1	AAIJ 21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$	
seen	616	2	ABAZOV 15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$	
seen	52	3	ABAZOV 14A D0	$B^+ \rightarrow J/\psi \phi K^+$	
seen	0.3k	4	CHATRCHYAN 14M CMS	$B^+ \rightarrow J/\psi \phi K^+$	
seen	14	5	AALTONEN 09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	6,7	AAIJ 17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$	
not seen		8	ABLIKIM 15 BES3	$e^+e^- \rightarrow \gamma\phi J/\psi$	
not seen		9	AAIJ 12AA LHCB	$p\bar{p} \rightarrow B^+ X$ at 7 TeV	

NODE=M193R01
 NODE=M193R01

NODE=M193R01;LINKAGE=F
 NODE=M193R01;LINKAGE=D
 NODE=M193R01;LINKAGE=A

NODE=M193R01;LINKAGE=C

NODE=M193R01;LINKAGE=AA
 NODE=M193R01;LINKAGE=E
 NODE=M193R01;LINKAGE=G
 NODE=M193R01;LINKAGE=B

NODE=M193R01;LINKAGE=AI

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13 σ .
² Statistical significance of more than 6 σ .
³ ABAZOV 14A reports $B(B^+ \rightarrow \chi_{c1}(4140) K^+ \rightarrow J/\psi \phi K^+)/B(B^+ \rightarrow J/\psi \phi K^+) = (19 \pm 7 \pm 4)\%$ with 3.1 σ significance.
⁴ From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 σ .
⁵ Statistical significance of 3.8 σ .
⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4 σ .
⁷ Superseded by AAIJ 21E.
⁸ Reported $\sigma(e^+e^- \rightarrow \gamma\chi_{c1}(4140)) \cdot B(\chi_{c1}(4140) \rightarrow J/\psi \phi) < 0.35, 0.28, \text{ and } 0.33$ pb at 4.23, 4.26, and 4.36 GeV, respectively, at 90% CL.
⁹ Reported $B(B^+ \rightarrow \chi_{c1}(4140) K^+) \cdot B(\chi_{c1}(4140) \rightarrow J/\psi \phi)/B(B^+ \rightarrow J/\psi \phi K^+) < 0.07$ at 90% CL.

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

NODE=M193R02
 NODE=M193R02

 $\chi_{c1}(4140)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
	Also	PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	17	MPL A32 1750139	T. Altonen <i>et al.</i>	(CDF Collab.)
ABAZOV	15M	PRL 115 232001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	15	PR D91 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABAZOV	14A	PR D89 012004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	14M	PL B734 261	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
AAIJ	12AA	PR D85 091103	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AALTONEN	09AH	PRL 102 242002	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M193

REFID=61150
 REFID=57657
 REFID=57636
 REFID=58161
 REFID=56957
 REFID=56368
 REFID=55650
 REFID=55753
 REFID=54263
 REFID=53235
 REFID=52968

NODE=M025

 $\psi(4160)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4191 ± 5 OUR AVERAGE			
4186.8 ± 8.7 ± 3.0	¹ ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
4191 $^{+9}_{-8}$	AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$
4191.7 ± 6.5	² ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 ± 7	³ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4151 ± 4	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4155 ± 5	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4159 ± 20	BRANDELIK	78C DASP	e^+e^-

NODE=M025M

NODE=M025M

OCCUR=2

¹ Could also be the $\psi(4230)$.² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.³ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.⁴ From a fit to Crystal Ball (OSTERHELD 86) data.⁵ From a fit to BES (BAI 02C) data.

NODE=M025M;LINKAGE=B
 NODE=M025M;LINKAGE=AB

NODE=M025M;LINKAGE=MO

NODE=M025M;LINKAGE=ST
 NODE=M025M;LINKAGE=SE

 $\psi(4160)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
69 ± 10 OUR AVERAGE			
55 ± 15 ± 53	¹ ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
65 $^{+22}_{-16}$	AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$
71.8 ± 12.3	² ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 ± 14	³ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
107 ± 10	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
107 ± 16	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
78 ± 20	BRANDELIK	78C DASP	e^+e^-

NODE=M025W

NODE=M025W

OCCUR=2

¹ Could also be the $\psi(4230)$.² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.³ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.⁴ From a fit to Crystal Ball (OSTERHELD 86) data.⁵ From a fit to BES (BAI 02C) data.

NODE=M025W;LINKAGE=B
 NODE=M025W;LINKAGE=AB

NODE=M025W;LINKAGE=MO

NODE=M025W;LINKAGE=ST
 NODE=M025W;LINKAGE=SE

$\psi(4160)$ DECAY MODES

NODE=M025215;NODE=M025

NODE=M025

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 e^+e^-	$(6.9 \pm 3.3) \times 10^{-6}$		DESIG=1
Γ_2 $\mu^+\mu^-$	seen		DESIG=33
Γ_3 $D\bar{D}$	seen		DESIG=15;OUR EVAL;→ UNCHECKED ←
Γ_4 $D^0\bar{D}^0$	seen		DESIG=16
Γ_5 D^+D^-	seen		DESIG=17
Γ_6 $D^*\bar{D} + \text{c.c.}$	seen		DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_7 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen		DESIG=19
Γ_8 $D^*(2010)^+D^- + \text{c.c.}$	seen		DESIG=20
Γ_9 $D^*\bar{D}^*$	seen		DESIG=21;OUR EVAL;→ UNCHECKED ←
Γ_{10} $D^*(2007)^0\bar{D}^*(2007)^0$	seen		DESIG=22
Γ_{11} $D^*(2010)^+D^*(2010)^-$	seen		DESIG=23
Γ_{12} $D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^- + \text{c.c.)}$	not seen		DESIG=24
Γ_{13} $D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)$	seen		DESIG=25
Γ_{14} $D^0D^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-)$	not seen		DESIG=26
Γ_{15} $D_s^+D_s^-$	not seen		DESIG=27
Γ_{16} $D_s^{*+}D_s^- + \text{c.c.}$	seen		DESIG=28
Γ_{17} $J/\psi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	DESIG=2
Γ_{18} $J/\psi\pi^0\pi^0$	$< 3 \times 10^{-3}$	90%	DESIG=3
Γ_{19} $J/\psi K^+K^-$	$< 2 \times 10^{-3}$	90%	DESIG=4
Γ_{20} $J/\psi\eta$	$< 8 \times 10^{-3}$	90%	DESIG=5
Γ_{21} $J/\psi\pi^0$	$< 1 \times 10^{-3}$	90%	DESIG=6
Γ_{22} $J/\psi\eta'$	$< 5 \times 10^{-3}$	90%	DESIG=7
Γ_{23} $J/\psi\pi^+\pi^-\pi^0$	$< 1 \times 10^{-3}$	90%	DESIG=8
Γ_{24} $\psi(2S)\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%	DESIG=9
Γ_{25} $\chi_{c1}\gamma$	$< 5 \times 10^{-3}$	90%	DESIG=10
Γ_{26} $\chi_{c2}\gamma$	$< 1.3 \%$	90%	DESIG=11
Γ_{27} $\chi_{c1}\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%	DESIG=12
Γ_{28} $\chi_{c2}\pi^+\pi^-\pi^0$	$< 8 \times 10^{-3}$	90%	DESIG=13
Γ_{29} $h_c(1P)\pi^+\pi^-$	$< 5 \times 10^{-3}$	90%	DESIG=29
Γ_{30} $h_c(1P)\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%	DESIG=30
Γ_{31} $h_c(1P)\eta$	$< 2 \times 10^{-3}$	90%	DESIG=31
Γ_{32} $h_c(1P)\pi^0$	$< 4 \times 10^{-4}$	90%	DESIG=32
Γ_{33} $\omega\pi^+\pi^-$	seen		DESIG=49;OUR EVAL;→ UNCHECKED ←
Γ_{34} $\phi\pi^+\pi^-$	$< 2 \times 10^{-3}$	90%	DESIG=14
Γ_{35} $\gamma\chi_{c1}(3872)$	$< 1.6 \times 10^{-3}$	90%	DESIG=44
Γ_{36} $\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.36 \times 10^{-4}$	90%	DESIG=35
Γ_{37} $\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.18 \times 10^{-4}$	90%	DESIG=36
Γ_{38} $\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.47 \times 10^{-4}$	90%	DESIG=37
Γ_{39} $\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi$	$< 1.26 \times 10^{-4}$	90%	DESIG=39
Γ_{40} $\gamma X(3930) \rightarrow \gamma\gamma J/\psi$	$< 8.8 \times 10^{-5}$	90%	DESIG=40
Γ_{41} $\gamma X(3940) \rightarrow \gamma\gamma J/\psi$	$< 1.79 \times 10^{-4}$	90%	DESIG=41
Γ_{42} $\omega\pi^0$	not seen		DESIG=47
Γ_{43} $\omega\eta$	not seen		DESIG=48
Γ_{44} K^+K^-	not seen		DESIG=42;OUR EVAL;→ UNCHECKED ←
Γ_{45} $K_S^0 K^\pm \pi^\mp$	seen		DESIG=43;OUR EVAL;→ UNCHECKED ←
Γ_{46} $p\bar{p}p\bar{p}$	not seen		DESIG=45
Γ_{47} $\Lambda\bar{\Lambda}$	$< 1.5 \times 10^{-6}$	90%	DESIG=46
Γ_{48} $\Sigma^+\bar{\Sigma}^-$	$< 2.0 \times 10^{-4}$	90%	DESIG=52
Γ_{49} $\Xi^0\bar{\Xi}^0$	$< 1.4 \times 10^{-4}$	90%	DESIG=55
Γ_{50} $\Xi^-\bar{\Xi}^+$	$< 8 \times 10^{-5}$	90%	DESIG=50
Γ_{51} $pK^-\bar{\Lambda} + \text{c.c.}$	$< 6 \times 10^{-6}$	90%	DESIG=51
Γ_{52} $\Lambda\bar{\Xi}^+K^- + \text{c.c.}$	seen		DESIG=53;OUR EVAL;→ UNCHECKED ←
Γ_{53} $\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$	$< 3.1 \times 10^{-6}$	90%	DESIG=54

$\psi(4160)$ PARTIAL WIDTHS

NODE=M025220

 $\Gamma(e^+e^-)$ Γ_1

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.48±0.22	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
0.4 to 1.1	² MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
0.83±0.08	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
0.84±0.13	⁴ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
0.77±0.23	BRANDELIK	78C DASP	e^+e^-

NODE=M025W1
NODE=M025W1

• • • We do not use the following data for averages, fits, limits, etc. • • •

OCCUR=2

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

NODE=M025W1;LINKAGE=AB

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.

NODE=M025W1;LINKAGE=MO

³ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M025W1;LINKAGE=ST

⁴ From a fit to BES (BAI 02C) data.

NODE=M025W1;LINKAGE=SE

 $\Gamma(\mu^+\mu^-)$ Γ_2

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.45±1.24±0.94	^{1,2} ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M025W2
NODE=M025W2

¹ From a fit to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+\mu^-) = \Gamma(e^+e^-)$.

NODE=M025W2;LINKAGE=A

² From solution 1 of 8 with equal fit quality. Other solutions range from $2.08 \pm 0.99 \pm 0.80$ to $2.45 \pm 1.24 \pm 0.94$ keV.

NODE=M025W2;LINKAGE=B

 $\psi(4160) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M025235

 $\Gamma(J/\psi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.17±0.04	86	^{1,2} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$
1.07±0.09	86	^{1,3} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$

NODE=M025R42
NODE=M025R42

• • • We do not use the following data for averages, fits, limits, etc. • • •

OCCUR=2

¹ Based on a fit to $\sigma(e^+e^- \rightarrow \eta' J/\psi)$ from $\sqrt{s} = 4.18$ to 4.60 GeV assuming interfering $\psi(4160)$ and $\psi(4260)$ contributions. At $\sqrt{s} = 4.18$ GeV, $\sigma(e^+e^- \rightarrow \eta' J/\psi) = 2.4 \pm 0.3 \pm 0.2$ pb.

NODE=M025R42;LINKAGE=A

² Solution I of the fit, corresponding to a phase of -0.03 ± 0.44 rad.

NODE=M025R42;LINKAGE=B

³ Solution II of the fit, corresponding to a phase of 2.54 ± 0.04 rad.

NODE=M025R42;LINKAGE=C

 $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{25}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

NODE=M025G01
NODE=M025G01

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G01;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.1	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M025G02
NODE=M025G02

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G02;LINKAGE=A

 $\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{33}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
0.0011±0.0008±0.0001	^{1,2} ABLIKIM	23AQ BES3	fit to cross sections
0.651 ±0.012 ±0.040	^{2,3} ABLIKIM	23AQ BES3	fit to cross sections

NODE=M025R48
NODE=M025R48

• • • We do not use the following data for averages, fits, limits, etc. • • •

OCCUR=3

¹ Solution I of the fit.

NODE=M025R48;LINKAGE=A

² From a fit to $e^+e^- \rightarrow \omega\pi^+\pi^-$ cross sections between 4 and 4.6 GeV. Recalculated from $12 \pi \Gamma(e^+e^-) B(\psi(4230) \rightarrow \omega\pi^+\pi^-)$. First uncertainty is from statistical and uncommon systematic uncertainties, and the second is a 6.2% common systematic uncertainty quoted in the paper.

NODE=M025R48;LINKAGE=C

³ Solution II of the fit.

NODE=M025R48;LINKAGE=B

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{45} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.71 ± 0.13 ± 0.12	¹ ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
0.0095 ± 0.0088 ± 0.0004	² ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M025R00
NODE=M025R00

OCCUR=5

NODE=M025R00;LINKAGE=A

NODE=M025R00;LINKAGE=D

¹ Solution I of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

² Solution II of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

$$\Gamma(\Lambda \bar{\Lambda}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{47} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 0.7 \times 10^{-3}$	90	¹ ABLIKIM	21AS BES3	$e^+ e^- \rightarrow \psi(4160)$
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¹ From a measurement of the $e^+ e^- \rightarrow \Lambda \bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M025R45
NODE=M025R45

NODE=M025R45;LINKAGE=A

$$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{48} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 94.6 \times 10^{-3}$	90	¹ ABLIKIM	24AH BES3	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$
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¹ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M025R52
NODE=M025R52

NODE=M025R52;LINKAGE=A

$$\Gamma(\Xi^0 \bar{\Xi}^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{49} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 69.0 \times 10^{-3}$	90	¹ ABLIKIM	24CD BES3	$e^+ e^- \rightarrow \psi(4160)$
-------------------------	----	----------------------	-----------	----------------------------------

¹ From a fit to $e^+ e^- \rightarrow \Xi^0 \bar{\Xi}^0$ cross sections.

NODE=M025R55
NODE=M025R55

NODE=M025R55;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{50} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 37.2 \times 10^{-3}$ (CL = 90%)				$[< 3.72 \times 10^{-2}$ eV (CL = 90%) OUR 2024 BEST LIMIT]
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$< 37.2 \times 10^{-3}$	90	¹ ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(4160)$
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¹ From a fit to $e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$ cross sections.

NODE=M025R49
NODE=M025R49

NODE=M025R49;LINKAGE=A

$$\Gamma(p K^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{51} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 3.0 \times 10^{-3}$	90	¹ ABLIKIM	23BL BES3	$e^+ e^- \rightarrow \psi(4160)$
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¹ From a fit to $e^+ e^- \rightarrow p K^- \bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M025R51
NODE=M025R51

NODE=M025R51;LINKAGE=A

$$\Gamma(\Lambda \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{52} \Gamma_1 / \Gamma$$

VALUE (10^{-3} eV)	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.1 ± 0.2	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$
1.5 ± 0.4	² ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$

¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Significance is 4.4σ . Solution 1 of 2.

² A fit to the Born cross section of $e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Significance is 4.4σ . Solution 2 of 2.

OCCUR=2

NODE=M025R53;LINKAGE=A

NODE=M025R53;LINKAGE=B

$$\Gamma(\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{53} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1.5 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$
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¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M025R54
NODE=M025R54

NODE=M025R54;LINKAGE=A

$$\psi(4160) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$$

NODE=M025230

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{20} / \Gamma \times \Gamma_1 / \Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.8 ± 0.9 ± 0.9	¹ WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$
12.8 ± 1.7 ± 2.0	² WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

NODE=M025R32
NODE=M025R32

OCCUR=2

NODE=M025R32;LINKAGE=A

¹ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

² Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

NODE=M025R32;LINKAGE=B

$\psi(4160)$ BRANCHING RATIOS

NODE=M025225

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	13BC LHCB	$B^+ \rightarrow K^+\mu^+\mu^-$
	¹ AAIJ 13BC report $B(B^+ \rightarrow K^+\psi(4160)) B(\psi(4160) \rightarrow \mu^+\mu^-) = (3.5_{-0.8}^{+0.9}) \times 10^{-9}$.		

NODE=M025R31
NODE=M025R31

NODE=M025R31;LINKAGE=A

 $\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$ Γ_3/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
$0.02 \pm 0.03 \pm 0.02$	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M025R14
NODE=M025R14 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	24BH BES3	$e^+e^- \rightarrow D^0\bar{D}^0$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$
seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M025R16
NODE=M025R16

NODE=M025R16;LINKAGE=A

¹ A precision measurement of the $e^+e^- \rightarrow D^0\bar{D}^0$ cross section shows complex structure in this mass region. $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	24BH BES3	$e^+e^- \rightarrow D^+D^-$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$
seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^+D^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^+D^-\gamma$

NODE=M025R17
NODE=M025R17

NODE=M025R17;LINKAGE=A

¹ A precision measurement of the $e^+e^- \rightarrow D^+D^-$ cross section shows complex structure in this mass region. $\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$

NODE=M025R18
NODE=M025R18 $\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ZHUKOVA	18 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^-\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M025R19
NODE=M025R19

NODE=M025R19;LINKAGE=A

¹ Supersedes PAKHLOVA 07. $\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$ Γ_6/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
$0.34 \pm 0.14 \pm 0.05$	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M025R15
NODE=M025R15 $\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

NODE=M025R20
NODE=M025R20 $\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ZHUKOVA	18 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M025R21
NODE=M025R21

NODE=M025R21;LINKAGE=A

¹ Supersedes PAKHLOVA 07.

$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^- + \text{c.c.))} / \Gamma_{\text{total}}$					Γ_{12} / Γ	NODE=M025R22 NODE=M025R22
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>			
not seen	PAKHLOVA	08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$		
$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)} / \Gamma_{\text{total}}$					Γ_{13} / Γ	NODE=M025R23 NODE=M025R23
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>			
seen	CRONIN-HEN..09		CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$		
$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)} / \Gamma_{\text{total}}$					Γ_{14} / Γ	NODE=M025R24 NODE=M025R24
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>			
not seen	PAKHLOVA	09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$		
$\Gamma(D_s^+ D_s^-) / \Gamma_{\text{total}}$					Γ_{15} / Γ	NODE=M025R25 NODE=M025R25
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>			
not seen	PAKHLOVA	11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$		
not seen	DEL-AMO-SA..10N		BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$		
not seen	CRONIN-HEN..09		CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$		
$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma_{\text{total}}$					Γ_{16} / Γ	NODE=M025R26 NODE=M025R26
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>			
seen	PAKHLOVA	11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$		
seen	DEL-AMO-SA..10N		BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$		
seen	CRONIN-HEN..09		CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$		
$\Gamma(J/\psi \pi^+ \pi^-) / \Gamma_{\text{total}}$					Γ_{17} / Γ	NODE=M025R01 NODE=M025R01
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<3	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(J/\psi \pi^0 \pi^0) / \Gamma_{\text{total}}$					Γ_{18} / Γ	NODE=M025R02 NODE=M025R02
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<3	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(J/\psi K^+ K^-) / \Gamma_{\text{total}}$					Γ_{19} / Γ	NODE=M025R03 NODE=M025R03
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<2	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(J/\psi \eta) / \Gamma_{\text{total}}$					Γ_{20} / Γ	NODE=M025R04 NODE=M025R04
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<8	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
possibly seen	¹ ABLIKIM	15L	BES3	$e^+ e^- \rightarrow J/\psi \eta$		
seen	WANG	13B	BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$		
¹ An enhancement around 4.2 GeV is observed.						
$\Gamma(J/\psi \pi^0) / \Gamma_{\text{total}}$					Γ_{21} / Γ	NODE=M025R05 NODE=M025R05
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(J/\psi \eta') / \Gamma_{\text{total}}$					Γ_{22} / Γ	NODE=M025R06 NODE=M025R06
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<5	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(J/\psi \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}}$					Γ_{23} / Γ	NODE=M025R07 NODE=M025R07
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$
$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma_{\text{total}}$					Γ_{24} / Γ	NODE=M025R08 NODE=M025R08
<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<4	90	COAN	06	CLEO	4.12-4.2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M025R04;LINKAGE=A

$\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons
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NODE=M025R09
NODE=M025R09

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<13	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons
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NODE=M025R10
NODE=M025R10

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<2	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons
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NODE=M025R11
NODE=M025R11

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<8	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons
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NODE=M025R12
NODE=M025R12

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<5	90	¹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$
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¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R27
NODE=M025R27

NODE=M025R27;LINKAGE=PE

 $\Gamma(h_c(1P)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<2	90	¹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$
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¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0\pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R28
NODE=M025R28

NODE=M025R28;LINKAGE=PE

 $\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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<2	90		¹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\eta$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen 41 ² ABLIKIM 17R BES3 $e^+e^- \rightarrow h_c(1P)\eta$

¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\eta) = 4.7 \pm 1.7 \pm 1.0 \pm 0.9$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

²An enhancement around 4.2 GeV is observed.

NODE=M025R29
NODE=M025R29

NODE=M025R29;LINKAGE=PE

NODE=M025R29;LINKAGE=A

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<0.4	90	¹ PEDLAR	11	CLEO $e^+e^- \rightarrow h_c(1P)\pi^0$
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¹At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0) = -0.7 \pm 1.8 \pm 0.7 \pm 0.1$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R30
NODE=M025R30

NODE=M025R30;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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<2	90	COAN	06	CLEO 4.12–4.2 $e^+e^- \rightarrow$ hadrons
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NODE=M025R13
NODE=M025R13

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
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<1.6 $\times 10^{-3}$ (CL = 90%)		[<1.9 $\times 10^{-3}$ (CL = 90%) OUR 2024 BEST LIMIT]	
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<1.6 $\times 10^{-3}$	90	^{1,2} XIAO	13 $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.011	90	^{1,3} XIAO	13 $\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$
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NODE=M025R43
NODE=M025R43

OCCUR=2

¹Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

²XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] < 0.68 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.

³XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \gamma J/\psi)] < 1.05 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \gamma J/\psi) = 10 \times 10^{-3}$.

NODE=M025R43;LINKAGE=A

NODE=M025R43;LINKAGE=B

NODE=M025R43;LINKAGE=C

$\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.36 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$

NODE=M025R35
 NODE=M025R35

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R35;LINKAGE=A

 $\Gamma(\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.18 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$

NODE=M025R36
 NODE=M025R36

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R36;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.47 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma J/\psi\pi^+\pi^-$

NODE=M025R37
 NODE=M025R37

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R37;LINKAGE=A

 $\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.26 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

NODE=M025R39
 NODE=M025R39

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R39;LINKAGE=A

 $\Gamma(\gamma X(3930) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.88 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

NODE=M025R40
 NODE=M025R40

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R40;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.79 \times 10^{-4}$	90	¹ XIAO	13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

NODE=M025R41
 NODE=M025R41

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R41;LINKAGE=A

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K	BES3 $e^+e^- \rightarrow \omega\pi^0$

NODE=M025R46
 NODE=M025R46

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K	BES3 $e^+e^- \rightarrow \omega\eta$

NODE=M025R47
 NODE=M025R47

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2 \times 10^{-5}$	90	¹ DRUZHININ	15	RVUE $e^+e^- \rightarrow \psi(3770)$

NODE=M025R33
 NODE=M025R33

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0 K_L^0$.

NODE=M025R33;LINKAGE=A

 $\Gamma(p\bar{p}p\bar{p})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	21D	BES3 4.0–4.6 $e^+e^- \rightarrow p\bar{p}p\bar{p}$

NODE=M025R44
 NODE=M025R44

 $\psi(4160)$ REFERENCES

NODE=M025

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24BH	PRL 133 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62924
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
ABLIKIM	23AQ	JHEP 2308 159	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62313
ABLIKIM	23BH	PRL 131 151903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62433
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	21D	PR D103 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61031
ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60210
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60744
ABLIKIM	19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59856
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)	REFID=58710
ABLIKIM	17R	PR D96 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58009
GAO	17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan		REFID=57991
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15L	PR D91 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56777
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)	REFID=56962

HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
AAIJ	13BC	PRL 111 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55229
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
XIAO	13	PR D87 057501	T. Xiao <i>et al.</i>	(NWES, WAYN)	REFID=55381
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53638
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=16787
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53532
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)	REFID=53540
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52724
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=53114
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52134
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51075
SETH	05A	PR D72 017501	K.K. Seth		REFID=50813
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)	REFID=51064
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22232

NODE=M190

X(4160)

$$I^G(J^{PC}) = ?^?(?^?)$$

OMITTED FROM SUMMARY TABLE

Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X$, $X \rightarrow D^*\bar{D}^*$

NODE=M190

A state with consistent mass and width is seen by AAIJ 21E in $B^+ \rightarrow X(4160)K^+$ with $X(4160) \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 4.8σ . The $J^{PC} = 2^{-+}$ assignment is favored over other assignments with a significance of more than 4σ .

X(4160) MASS

NODE=M190M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4153⁺²³₋₂₁ OUR AVERAGE				
4146 ± 18 ± 33	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$
4156 ⁺²⁵ ₋₂₀ ± 15	24	PAKHLOV	08 BELL	$e^+e^- \rightarrow J/\psi X$

NODE=M190M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8σ .

NODE=M190M;LINKAGE=A

X(4160) WIDTH

NODE=M190W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
136⁺⁶⁰₋₃₅ OUR AVERAGE				
135 ± 28 ⁺⁵⁹ ₋₃₀	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$
139 ⁺¹¹¹ ₋₆₁ ± 21	24	PAKHLOV	08 BELL	$e^+e^- \rightarrow J/\psi X$

NODE=M190W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8σ .

NODE=M190W;LINKAGE=A

X(4160) DECAY MODES

NODE=M190215;NODE=M190

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}$	not seen
Γ_2 $D^*\bar{D}^+$ c.c.	not seen
Γ_3 $D^*\bar{D}^*$	seen
Γ_4 $J/\psi\phi$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4

X(4160) BRANCHING RATIOS

NODE=M190225

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_3
<0.09	90	PAKHLOV	08 BELL	$e^+e^- \rightarrow J/\psi X$	

NODE=M190R01
 NODE=M190R01

$\Gamma(D^*\bar{D} + c.c.)/\Gamma(D^*\bar{D}^*)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.22	90	PAKHLOV	08	BELL	$e^+e^- \rightarrow J/\psi X$

NODE=M190R02
NODE=M190R02

$\Gamma(J/\psi\phi)/\Gamma_{total}$					Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M190R00
NODE=M190R00

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8 σ .

NODE=M190R00;LINKAGE=A

X(4160) REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij et al.	(LHCb Collab.)
PAKHLOV	08	PRL 100 202001	P. Pakhlov et al.	(BELLE Collab.)

NODE=M190

REFID=61150
REFID=52302

NODE=M074

$\psi(4230)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4230)$; was $\psi(4260)$

The original $\psi(4260)$ (also known as $Y(4260)$) was observed by AUBERT,B 05I as a peak in the energy dependence of the $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ cross section and was confirmed by HE 06B, YUAN 07, LEES 12AC, and LIU 13B in the same process. A higher-statistics analysis by ABLIKIM 17B revealed an asymmetry in the cross section and resulted in a shift of the peak position to a lower mass. The $\psi(4260)$ was therefore renamed $\psi(4230)$. The energy-dependent cross sections for e^+e^- to other channels also exhibit peaks in the same mass region. The parameters corresponding to those peaks are also listed here, but the number of states in this region remains to be determined.

NODE=M074

For details see the review on "Spectroscopy of mesons containing two heavy quarks."

$\psi(4230)$ MASS

NODE=M074M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4222.2 ± 2.4 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
[4222.1 ± 2.3 MeV OUR 2024 AVERAGE		Scale factor = 1.7]		
4219.7 ± 2.5 ± 4.5		¹ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
4226.9 ± 6.6 ± 22.0		² ABLIKIM	23U BES3	$e^+e^- \rightarrow K_S^0 K_S^0 J/\psi$
4209.6 ± 4.7 ± 5.9		³ ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$
4221.4 ± 1.5 ± 2.0		⁴ ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4225.3 ± 2.3 ± 21.5		⁵ ABLIKIM	22AU BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$
4234.4 ± 3.2 ± 0.2		⁶ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4216.7 ± 8.9 ± 4.1		⁷ ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+ \mu^-$
4220.4 ± 2.4 ± 2.3		⁸ ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
4218.5 ± 1.6 ± 4.0		⁹ ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4228.6 ± 4.1 ± 6.3		ABLIKIM	19R BES3	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + c.c.$
4200.6 ⁺ _{-13.3} ± 7.9 ± 3.0		¹⁰ ABLIKIM	19V BES3	$e^+e^- \rightarrow \gamma \chi_{c1}(3872)$
4218 ± 5.5 ± 4.5 ± 0.9		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4231.9 ± 5.3 ± 4.9		ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0$, $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$
4218.6 ± 3.8 ± 2.5		⁸ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
4222.0 ± 3.1 ± 1.4		¹¹ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4209.5 ± 7.4 ± 1.4		¹² ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4209.1 ± 6.8 ± 7.0		¹³ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4223.3 ± 1.6 ± 2.5		¹⁴ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4230 ± 8 ± 6 180		¹⁵ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4258.6 ± 8.3 ± 12.1		¹⁶ LIU	13B BELL	$e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4245 ± 5 ± 4		¹⁷ LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4247 ± 12 ± 17 ± 32		^{16,18} YUAN	07 BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4284 ± 17 ± 16 ± 413.6		HE	06B CLEO	$9.4-10.6 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4259 ± 8 ± 2 ± 125		¹⁹ AUBERT,B	05I BABR	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

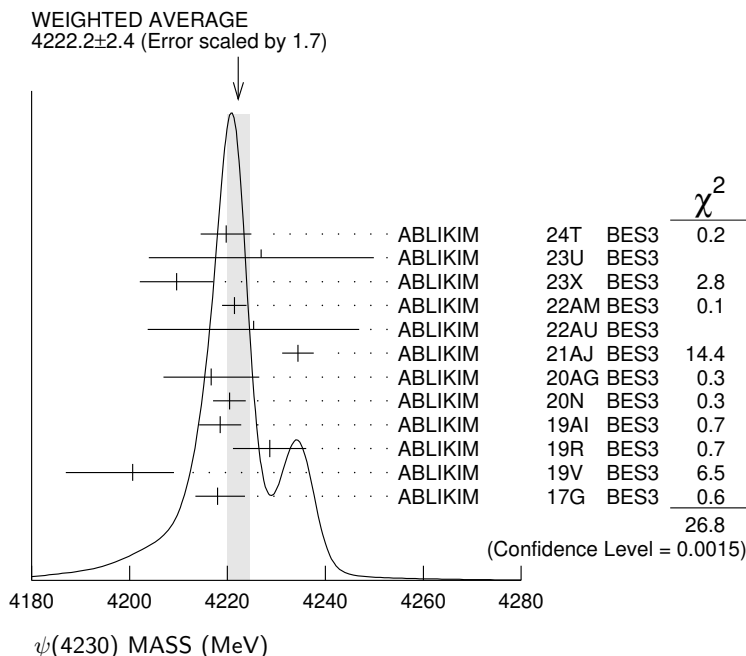
NODE=M074M
NEW

OCCUR=2

OCCUR=2

- 1 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.808\text{--}4.951$ GeV. Supersedes ABLIKIM 200.
- 2 From a three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.
- 3 From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4675.3 ± 29.7 (218.3 \pm 73.5) MeV and 4469.1 ± 26.4 (246.3 \pm 37.9) MeV.
- 4 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.
- 5 From a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV and a total width of $111.1 \pm 30.1 \pm 15.2$ MeV.
- 6 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.
- 7 Solution 1 of 8 with equal fit quality to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from $4212.8 \pm 7.2 \pm 4.0$ to $4219.4 \pm 11.2 \pm 4.1$ MeV.
- 8 From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.
- 9 From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.
- 10 Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$.
- 11 From a three-resonance fit. Superseded by ABLIKIM 22AM.
- 12 From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.
- 13 From a three-resonance fit.
- 14 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- 15 From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.
- 16 From a two-resonance fit.
- 17 From a single-resonance fit. Supersedes AUBERT,B 05i.
- 18 Superseded by LIU 13B.
- 19 From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074M;LINKAGE=K
 NODE=M074M;LINKAGE=I
 NODE=M074M;LINKAGE=J
 NODE=M074M;LINKAGE=F
 NODE=M074M;LINKAGE=H
 NODE=M074M;LINKAGE=C
 NODE=M074M;LINKAGE=HP
 NODE=M074M;LINKAGE=GP
 NODE=M074M;LINKAGE=CP
 NODE=M074M;LINKAGE=FP
 NODE=M074M;LINKAGE=G
 NODE=M074M;LINKAGE=BP
 NODE=M074M;LINKAGE=A
 NODE=M074M;LINKAGE=CA
 NODE=M074M;LINKAGE=AP
 NODE=M074M;LINKAGE=YU
 NODE=M074M;LINKAGE=LE
 NODE=M074M;LINKAGE=YN
 NODE=M074M;LINKAGE=AU



psi(4230) WIDTH

NODE=M074W
 NODE=M074W
 NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 8 OUR AVERAGE		Error includes scale factor of 3.7. See the ideogram below.		
[49 ± 7 MeV OUR 2024 AVERAGE		Scale factor = 3.4]		
80.7 ± 4.4 ± 1.4	1	ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
71.7 ± 16.2 ± 32.8	2	ABLIKIM	23U BES3	$e^+e^- \rightarrow K_S^0 K_S^0 J/\psi$
81.6 ± 17.8 ± 9.0	3	ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$
41.8 ± 2.9 ± 2.7	4	ABLIKIM	22AM BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
72.9 ± 6.1 ± 30.8	5	ABLIKIM	22AU BES3	$e^+e^- \rightarrow K^+K^- J/\psi$

17.6±18.1± 0.9	⁶ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
47.2±22.8±10.5	⁷ ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+\mu^-$
46.2± 4.7± 2.1	⁸ ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
28.2± 3.9± 1.6	⁹ ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
77.0± 6.8± 6.3	ABLIKIM	19R BES3	$e^+e^- \rightarrow \pi^+D^0D^{*-} + \text{c.c.}$
115 $\begin{smallmatrix} +38 \\ -26 \end{smallmatrix}$ ±12	¹⁰ ABLIKIM	19V BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
66.0 $\begin{smallmatrix} +12.3 \\ -8.3 \end{smallmatrix}$ ± 0.4	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

• • • We do not use the following data for averages, fits, limits, etc. • • •

41.2±16.0±16.4	ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0,$ $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$	OCCUR=2
82.0± 5.7± 0.4	⁸ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$	
44.1± 4.3± 2.0	¹¹ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$	
80.1±24.6± 2.9	¹² ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	
76.6±14.2± 2.4	¹³ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	
54.2± 2.6± 1.0	¹⁴ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi \text{ or } \psi(2S)$	
38 ±12 ± 2 180	¹⁵ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$	
134.1±16.4± 5.5	¹⁶ LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$	
114 $\begin{smallmatrix} +16 \\ -15 \end{smallmatrix}$ ± 7	¹⁷ LEES	12AC BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$	
108 ±19 ±10	^{16,18} YUAN	07 BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$	
73 $\begin{smallmatrix} +39 \\ -25 \end{smallmatrix}$ ± 5 13.6	HE	06B CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$	
88 ±23 $\begin{smallmatrix} +6 \\ -4 \end{smallmatrix}$ 125	¹⁹ AUBERT,B	05I BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$	

¹ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.808\text{--}4.951$ GeV. Supersedes ABLIKIM 200.

NODE=M074W;LINKAGE=J

² From a three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.

NODE=M074W;LINKAGE=H

³ From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4675.3 ± 29.7 (218.3 ± 73.5) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.

NODE=M074W;LINKAGE=I

⁴ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.

NODE=M074W;LINKAGE=F

⁵ From a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV and a total width of $111.1 \pm 30.1 \pm 15.2$ MeV.

NODE=M074W;LINKAGE=G

⁶ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

NODE=M074W;LINKAGE=D

⁷ Solution 1 of 8 with equal fit quality to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from $36.4 \pm 16.8 \pm 8.1$ to $49.6 \pm 22.6 \pm 11.0$ MeV.

NODE=M074W;LINKAGE=GP

⁸ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

NODE=M074W;LINKAGE=FP

⁹ From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.

NODE=M074W;LINKAGE=CP

¹⁰ Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$.

NODE=M074W;LINKAGE=EP

¹¹ From a three-resonance fit. Superseded by ABLIKIM 22AM.

NODE=M074W;LINKAGE=E

¹² From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.

NODE=M074W;LINKAGE=BP

¹³ From a three-resonance fit.

NODE=M074W;LINKAGE=C

¹⁴ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.

NODE=M074W;LINKAGE=B

¹⁵ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M074W;LINKAGE=AP

¹⁶ From a two-resonance fit.

NODE=M074W;LINKAGE=YU

¹⁷ From a single-resonance fit. Supersedes AUBERT,B 05I.

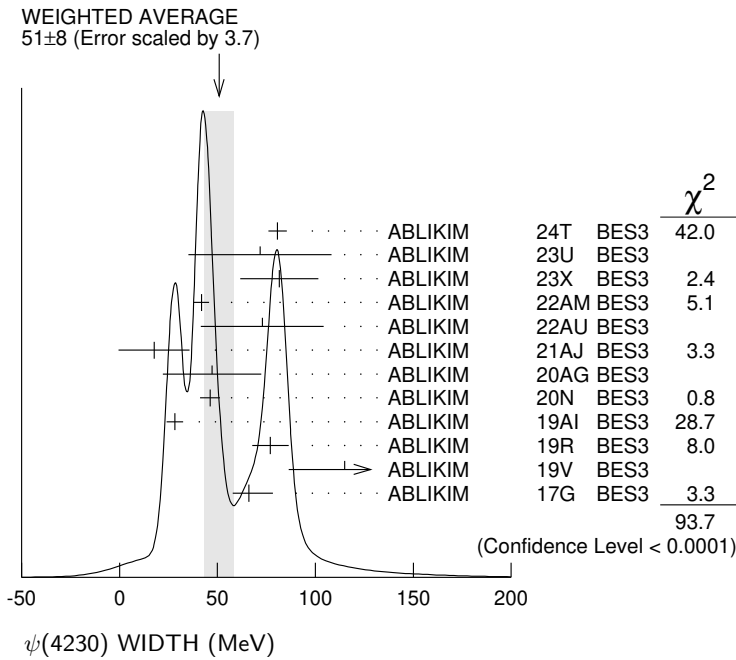
NODE=M074W;LINKAGE=LE

¹⁸ Superseded by LIU 13B.

NODE=M074W;LINKAGE=YN

¹⁹ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W;LINKAGE=AU



psi(4230) DECAY MODES

NODE=M074215;NODE=M074

Mode	Fraction (Γ_i/Γ)	
Γ_1 $e^+ e^-$		DESIG=1
Γ_2 $\mu^+ \mu^-$	$(3.0 \pm 2.7) \times 10^{-5}$	DESIG=63
Γ_3 $\eta_c(1S) \pi^+ \pi^-$	not seen	DESIG=65
Γ_4 $\eta_c(1S) \pi^+ \pi^- \pi^0$	seen	DESIG=64
Γ_5 $J/\psi \pi^+ \pi^-$	seen	DESIG=2
Γ_6 $J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-$	seen	DESIG=41;OUR EVAL;→ UNCHECKED ←
Γ_7 $T_{cc1}(3900)^\pm \pi^\mp, T_{cc1}^\pm \rightarrow J/\psi \pi^\pm$	seen	DESIG=43;OUR EVAL;→ UNCHECKED ←
Γ_8 $J/\psi \pi^0 \pi^0$	seen	DESIG=4
Γ_9 $J/\psi K^+ K^-$	seen	DESIG=5;OUR EVAL;→ UNCHECKED ←
Γ_{10} $J/\psi K_S^0 K_S^0$	not seen	DESIG=44
Γ_{11} $J/\psi \eta$	seen	DESIG=6
Γ_{12} $J/\psi \pi^0$	not seen	DESIG=7;OUR EVAL;→ UNCHECKED ←
Γ_{13} $J/\psi \eta'$	seen	DESIG=8;OUR EVAL;→ UNCHECKED ←
Γ_{14} $J/\psi \pi^+ \pi^- \pi^0$	not seen	DESIG=9;OUR EVAL;→ UNCHECKED ←
Γ_{15} $J/\psi \eta \pi^0$	not seen	DESIG=45
Γ_{16} $J/\psi \eta \eta$	not seen	DESIG=10;OUR EVAL;→ UNCHECKED ←
Γ_{17} $\psi(2S) \pi^+ \pi^-$	seen	DESIG=11
Γ_{18} $\psi(2S) \eta$	not seen	DESIG=12;OUR EVAL;→ UNCHECKED ←
Γ_{19} $\chi_{c0} \omega$	seen	DESIG=13
Γ_{20} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen	DESIG=16;OUR EVAL;→ UNCHECKED ←
Γ_{21} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen	DESIG=17;OUR EVAL;→ UNCHECKED ←
Γ_{22} $h_c(1P) \pi^+ \pi^-$	seen	DESIG=40
Γ_{23} $\phi \pi^+ \pi^-$	not seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_{24} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen	DESIG=22;OUR EVAL;→ UNCHECKED ←
Γ_{25} $\phi K^+ K^-$	not seen	DESIG=72;OUR EVAL;→ UNCHECKED ←
Γ_{26} $\phi K_S^0 K_S^0$	not seen	DESIG=73;OUR EVAL;→ UNCHECKED ←
Γ_{27} $\phi \eta$	not seen	DESIG=76
Γ_{28} $\phi \eta'$	not seen	DESIG=70;OUR EVAL;→ UNCHECKED ←
Γ_{29} $D \bar{D}$	not seen	DESIG=19;OUR EVAL;→ UNCHECKED ←
Γ_{30} $D^0 \bar{D}^0$	possibly seen	DESIG=31
Γ_{31} $D^+ D^-$	possibly seen	DESIG=32
Γ_{32} $D^* \bar{D} + c.c.$	not seen	DESIG=23;OUR EVAL;→ UNCHECKED ←
Γ_{33} $D^*(2007)^0 \bar{D}^0 + c.c.$	not seen	DESIG=33
Γ_{34} $D^*(2010)^+ D^- + c.c.$	not seen	DESIG=34
Γ_{35} $D^* \bar{D}^*$	not seen	DESIG=24;OUR EST;→ UNCHECKED ←

Γ ₃₆	$D^*(2007)^0 \bar{D}^*(2007)^0$	not seen	DESIG=35
Γ ₃₇	$D^*(2010)^+ D^*(2010)^-$	not seen	DESIG=36
Γ ₃₈	$D \bar{D} \pi + c.c.$	not seen	DESIG=37; OUR EST; → UNCHECKED ←
Γ ₃₉	$D^0 D^- \pi^+ + c.c. (excl. D^*(2007)^0 \bar{D}^{*0} + c.c., D^*(2010)^+ D^- + c.c.)$	not seen	DESIG=38
Γ ₄₀	$D \bar{D}^* \pi + c.c. (excl. D^* \bar{D}^*)$	not seen	DESIG=25
Γ ₄₁	$D^0 D^*(2010)^- \pi^+ + c.c.$	seen	DESIG=30
Γ ₄₂	$D_1(2420) \bar{D} + c.c.$	not seen	DESIG=50
Γ ₄₃	$D^* \bar{D}^* \pi$	seen	DESIG=26
Γ ₄₄	$D^{*0} D^{*-} \pi^+$	seen	DESIG=74; OUR EVAL; → UNCHECKED ←
Γ ₄₅	$D_s^+ D_s^-$	not seen	DESIG=27
Γ ₄₆	$D_s^{*+} D_s^- + c.c.$	not seen	DESIG=28
Γ ₄₇	$D_s^{*+} D_s^{*-}$	not seen	DESIG=29
Γ ₄₈	$\rho \bar{\rho}$	not seen	DESIG=3; OUR EVAL; → UNCHECKED ←
Γ ₄₉	$\rho \bar{\rho} \pi^0$	not seen	DESIG=46; OUR EVAL; → UNCHECKED ←
Γ ₅₀	$\rho \bar{\rho} \eta$	not seen	DESIG=61
Γ ₅₁	$\omega \pi^+ \pi^-$	seen	DESIG=71; OUR EVAL; → UNCHECKED ←
Γ ₅₂	$\rho \bar{\rho} \omega$	not seen	DESIG=62
Γ ₅₃	$\Xi^0 \Xi^0$		DESIG=80
Γ ₅₄	$\Xi^- \Xi^+$	not seen	DESIG=51; OUR EVAL; → UNCHECKED ←
Γ ₅₅	$\pi^+ \pi^+ \pi^- \pi^-$	not seen	DESIG=53; OUR EVAL; → UNCHECKED ←
Γ ₅₆	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	not seen	DESIG=54; OUR EVAL; → UNCHECKED ←
Γ ₅₇	$\omega \pi^0$	not seen	DESIG=68
Γ ₅₈	$\omega \eta$	not seen	DESIG=69
Γ ₅₉	$K_S^0 K^\pm \pi^\mp$	not seen	DESIG=20; OUR EVAL; → UNCHECKED ←
Γ ₆₀	$K_S^0 K^\pm \pi^\mp \pi^0$	not seen	DESIG=48; OUR EVAL; → UNCHECKED ←
Γ ₆₁	$K_S^0 K^\pm \pi^\mp \eta$	not seen	DESIG=49; OUR EVAL; → UNCHECKED ←
Γ ₆₂	$K^+ K^- \pi^0$	not seen	DESIG=21; OUR EVAL; → UNCHECKED ←
Γ ₆₃	$K^+ K^- \pi^+ \pi^-$	not seen	DESIG=55; OUR EVAL; → UNCHECKED ←
Γ ₆₄	$K^+ K^- \pi^+ \pi^- \pi^0$	not seen	DESIG=56; OUR EVAL; → UNCHECKED ←
Γ ₆₅	$K^+ K^+ K^- K^-$	not seen	DESIG=57; OUR EVAL; → UNCHECKED ←
Γ ₆₆	$K^+ K^+ K^- K^- \pi^0$	not seen	DESIG=58; OUR EVAL; → UNCHECKED ←
Γ ₆₇	$\rho \bar{\rho} \pi^+ \pi^-$	not seen	DESIG=59; OUR EVAL; → UNCHECKED ←
Γ ₆₈	$\rho \bar{\rho} \pi^+ \pi^- \pi^0$	not seen	DESIG=60; OUR EVAL; → UNCHECKED ←
Γ ₆₉	$\rho \bar{\rho} \rho \bar{\rho}$	not seen	DESIG=67
Γ ₇₀	$\Lambda \bar{\Lambda}$	not seen	DESIG=52; OUR EVAL; → UNCHECKED ←
Γ ₇₁	$\Sigma^+ \bar{\Sigma}^-$	not seen	DESIG=77; OUR EVAL; → UNCHECKED ←
Γ ₇₂	$\rho K^- \bar{\Lambda} + c.c.$	not seen	DESIG=75; OUR EVAL; → UNCHECKED ←
Γ ₇₃	$\Lambda \Xi^+ K^- + c.c.$	not seen	DESIG=78; OUR EVAL; → UNCHECKED ←
Γ ₇₄	$\Sigma^0 \Xi^+ K^- + c.c.$	not seen	DESIG=79; OUR EVAL; → UNCHECKED ←

Radiative decays

Γ ₇₅	$\eta_c(1S) \gamma$	possibly seen	NODE=M074; CLUMP=C DESIG=47
Γ ₇₆	$\eta_c(1S) \pi^0 \gamma$	not seen	DESIG=66
Γ ₇₇	$\chi_{c1} \gamma$	not seen	DESIG=14; OUR EVAL; → UNCHECKED ←
Γ ₇₈	$\chi_{c2} \gamma$	not seen	DESIG=15; OUR EVAL; → UNCHECKED ←
Γ ₇₉	$\chi_{c1}(3872) \gamma$	seen	DESIG=42

$\psi(4230)$ PARTIAL WIDTHS

$\Gamma(\mu^+ \mu^-)$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.53 ± 1.26 ± 0.54	1,2 ABLIKIM	20AG BES3	$e^+ e^- \rightarrow \mu^+ \mu^-$

¹ From a fit to the $e^+ e^- \rightarrow \mu^+ \mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$.

² From solution 1 of 8 with equal fit quality. Other solutions range from $1.09 \pm 0.84 \pm 0.39$ to $1.53 \pm 1.26 \pm 0.54$ keV.

Γ₂

NODE=M074235

NODE=M074W01
NODE=M074W01

NODE=M074W01; LINKAGE=A

NODE=M074W01; LINKAGE=B

$\psi(4230) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M074230

 $\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_5 \Gamma_1 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M074G1
NODE=M074G1**9.2±1.0 OUR AVERAGE**

9.2±0.8±0.7		¹ LEES	12AC BABR	10.58 e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$
8.9 ^{+3.9} _{-3.1} ±1.8	8.1	HE	06B CLEO	9.4–10.6 e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

6.4±0.8±0.6		² LIU	13B BELL	e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$
20.5±1.4±2.0		³ LIU	13B BELL	e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$
6.0±1.2 ^{+4.7} _{-0.5}		^{2,4} YUAN	07 BELL	10.58 e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$
20.6±2.3 ^{+9.1} _{-1.7}		^{3,4} YUAN	07 BELL	10.58 e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$
5.5±1.0 ^{+0.8} _{-0.7}	125	⁵ AUBERT,B	05I BABR	10.58 e ⁺ e ⁻ → $\gamma \pi^+ \pi^- J/\psi$

OCCUR=2

OCCUR=2

¹ From a single-resonance fit. Supersedes AUBERT,B 05I.² Solution I of two equivalent solutions in a fit using two interfering resonances.³ Solution II of two equivalent solutions in a fit using two interfering resonances.⁴ Superseded by LIU 13B.⁵ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.NODE=M074G1;LINKAGE=LE
NODE=M074G1;LINKAGE=YOU
NODE=M074G1;LINKAGE=YA
NODE=M074G1;LINKAGE=YN
NODE=M074G1;LINKAGE=AU $\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M074G3
NODE=M074G3

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

0.42±0.04±0.15		¹ ABLIKIM	22AU BES3	e ⁺ e ⁻ → $K^+ K^- J/\psi$
0.29±0.02±0.10		² ABLIKIM	22AU BES3	e ⁺ e ⁻ → $K^+ K^- J/\psi$
<1.7	90	³ SHEN	14 BELL	9.4–10.9 e ⁺ e ⁻ → $\gamma K^+ K^- J/\psi$
<1.2	90	⁴ YUAN	08 BELL	e ⁺ e ⁻ → $\gamma K^+ K^- J/\psi$

OCCUR=2

¹ Solution I from a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV, a total width of $111.1 \pm 30.1 \pm 15.2$ MeV, and $\Gamma_{ee} \cdot B = 1.35 \pm 0.14 \pm 0.07$ eV. The phase difference is $1.72 \pm 0.09 \pm 0.52$ rad.² Solution II from a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV, a total width of $111.1 \pm 30.1 \pm 15.2$ MeV, and $\Gamma_{ee} \cdot B = 0.41 \pm 0.08 \pm 0.13$ eV. The phase difference is $5.49 \pm 0.35 \pm 0.58$ rad.³ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $\psi(4260)$ amplitude with mass and width from LIU 13B. Supersedes YUAN 08. The shape of the cross section observed by ABLIKIM 18N between 4.2 and 4.3 GeV is incompatible with that of $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ in ABLIKIM 13T and ABLIKIM 17B. They also observe a broad enhancement around 4.5 GeV.⁴ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $\psi(4260)$ amplitude with mass and width from YUAN 07.

NODE=M074G3;LINKAGE=B

NODE=M074G3;LINKAGE=C

NODE=M074G3;LINKAGE=A

NODE=M074G3;LINKAGE=YOU

 $\Gamma(J/\psi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{10} \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M074G02
NODE=M074G02

<0.85	90	¹ SHEN	14 BELL	9.4–10.9 e ⁺ e ⁻ → $\gamma K_S^0 K_S^0 J/\psi$
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

0.13±0.02±0.05		^{2,3} ABLIKIM	23U BES3	e ⁺ e ⁻ → $K_S K_S J/\psi$
0.14±0.03±0.06		^{2,4} ABLIKIM	23U BES3	e ⁺ e ⁻ → $K_S K_S J/\psi$
0.18±0.05±0.07		^{2,5} ABLIKIM	23U BES3	e ⁺ e ⁻ → $K_S K_S J/\psi$
0.20±0.04±0.07		^{2,6} ABLIKIM	23U BES3	e ⁺ e ⁻ → $K_S K_S J/\psi$

OCCUR=2

OCCUR=3

OCCUR=4

¹ From a fit of the $K_S^0 K_S^0 J/\psi$ mass range from 4.4 to 5.5 GeV including a coherent $\psi(4260)$ amplitude with mass and width from LIU 13B.² A three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.³ Solution I.⁴ Solution II.⁵ Solution III.⁶ Solution IV.

NODE=M074G02;LINKAGE=A

NODE=M074G02;LINKAGE=B

NODE=M074G02;LINKAGE=F

NODE=M074G02;LINKAGE=C

NODE=M074G02;LINKAGE=D

NODE=M074G02;LINKAGE=E

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$4.0 \pm 0.5 \pm 0.1$		¹ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
$5.5 \pm 0.7 \pm 0.3$		² ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
$8.7 \pm 1.0 \pm 0.4$		³ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
$11.9 \pm 1.1 \pm 0.6$		⁴ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
8.0 ± 1.7		⁵ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
4.8 ± 1.0		⁶ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
7.0 ± 1.5		⁷ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
<14.2	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M074G01
NODE=M074G01OCCUR=2
OCCUR=3
OCCUR=4OCCUR=2
OCCUR=3¹ Solution 1 of 4. Supersedes ABLIKIM 200.² Solution 2 of 4. Supersedes ABLIKIM 200.³ Solution 3 of 4. Supersedes ABLIKIM 200.⁴ Solution 4 of 4. Supersedes ABLIKIM 200.⁵ Solution 1 of three equivalent fit solutions using three resonant structures.⁶ Solution 2 of three equivalent fit solutions using three resonant structures.⁷ Solution 3 of three equivalent fit solutions using three resonant structures.NODE=M074G01;LINKAGE=D
NODE=M074G01;LINKAGE=E
NODE=M074G01;LINKAGE=F
NODE=M074G01;LINKAGE=G
NODE=M074G01;LINKAGE=A
NODE=M074G01;LINKAGE=B
NODE=M074G01;LINKAGE=C $\Gamma(J/\psi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.06 ± 0.03	46	^{1,2} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$
1.38 ± 0.11	46	^{1,3} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$

NODE=M074R34
NODE=M074R34

OCCUR=2

NODE=M074R34;LINKAGE=A

¹ Based on a fit to $\sigma(e^+e^- \rightarrow \eta' J/\psi)$ from $\sqrt{s} = 4.18$ to 4.60 GeV assuming interfering $\psi(4160)$ and $\psi(4260)$ contributions. At $\sqrt{s} = 4.23$ GeV, $\sigma(e^+e^- \rightarrow \eta' J/\psi) = 3.6 \pm 0.6 \pm 0.3$ pb.² Solution I of the fit, corresponding to a phase of -0.03 ± 0.44 rad.³ Solution II of the fit, corresponding to a phase of 2.54 ± 0.04 rad.NODE=M074R34;LINKAGE=B
NODE=M074R34;LINKAGE=C $\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.59 ± 0.75		¹ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.63 ± 0.78		² ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
0.02 ± 0.01		³ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.6 ± 1.3		⁴ ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.8 ± 1.4		⁵ ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
<4.3	90	⁶ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$7.4^{+2.1}_{-1.7}$		⁷ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

NODE=M074G7
NODE=M074G7OCCUR=2
OCCUR=3

OCCUR=2

OCCUR=2

¹ Solution I of four equivalent solutions in a fit using three interfering resonances.² Solution II of four equivalent solutions in a fit using three interfering resonances.³ Solutions III and IV of four equivalent solutions in a fit using three interfering resonances.⁴ Solution I of two equivalent solutions in a fit using two interfering resonances.⁵ Solution II of two equivalent solutions in a fit using two interfering resonances.⁶ For constructive interference with the $\psi(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.⁷ For destructive interference with the $\psi(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.NODE=M074G7;LINKAGE=A
NODE=M074G7;LINKAGE=B
NODE=M074G7;LINKAGE=C
NODE=M074G7;LINKAGE=AA
NODE=M074G7;LINKAGE=BB
NODE=M074G7;LINKAGE=LI
NODE=M074G7;LINKAGE=LU $\Gamma(\chi_{c0}\omega) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$2.5 \pm 0.2 \pm 0.3$		¹ ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
$2.7 \pm 0.5 \pm 0.4$	180	² ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

NODE=M074G05
NODE=M074G05

NODE=M074G05;LINKAGE=B

NODE=M074G05;LINKAGE=A

¹ From a fit of the measured cross section from $\sqrt{s} = 4.178$ –4.278 GeV. Supersedes ABLIKIM 15C.² From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21$ –4.42 GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$. $\Gamma(h_c(1P)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
$4.6^{+2.9}_{-1.4} \pm 0.8$	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

NODE=M074R47
NODE=M074R47

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M074G2
NODE=M074G2

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	¹ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M074G6
NODE=M074G6

¹ AUBERT 07AK reports $[\Gamma(\psi(4230) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(4230) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] < 0.14$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = 49.9 \times 10^{-2}$.

NODE=M074G6;LINKAGE=AU

$$\Gamma(\phi K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.75	90	ABLIKIM	23AE BES3	$e^+e^- \rightarrow \phi K^+K^-$

NODE=M074R63
NODE=M074R63

$$\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	ABLIKIM	23AE BES3	$e^+e^- \rightarrow \phi K_S^0 K_S^0$

NODE=M074R64
NODE=M074R64

$$\Gamma(\phi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.53	90	ABLIKIM	23R BES3	$e^+e^- \rightarrow \phi\eta'$

NODE=M074R61
NODE=M074R61

$$\Gamma(D^{*0}D^{*-}\pi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{44}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
	¹ ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$

NODE=M074R65
NODE=M074R65

• • • We do not use the following data for averages, fits, limits, etc. • • •

5 to 22 ¹ ABLIKIM 23X BES3 $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$

¹ From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. Depending on solutions I – VIII with the same fit qualities.

NODE=M074R65;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
	^{1,2} ABLIKIM	23AQ BES3	fit to cross sections
	^{2,3} ABLIKIM	23AQ BES3	fit to cross sections

NODE=M074R62
NODE=M074R62

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.487 ± 0.008 ± 0.030 ^{1,2} ABLIKIM 23AQ BES3 fit to cross sections
0.0005 ± 0.0003 ± 0.0001 ^{2,3} ABLIKIM 23AQ BES3 fit to cross sections

OCCUR=2

¹ Solution I of the fit.

² From a fit to $e^+e^- \rightarrow \omega\pi^+\pi^-$ cross sections between 4 and 4.6 GeV. Recalculated from 12 $\pi\Gamma(e^+e^-)B(\psi(4230) \rightarrow \omega\pi^+\pi^-)$. First uncertainty is from statistical and uncommon systematic uncertainties, and the second is a 6.2% common systematic uncertainty quoted in the paper.

NODE=M074R62;LINKAGE=A
NODE=M074R62;LINKAGE=C

³ Solution II of the fit.

NODE=M074R62;LINKAGE=B

$$\Gamma(\pi^+\pi^+\pi^-\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{55}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<32	90	ABLIKIM	21AW BES3	$e^+e^- \rightarrow 2\pi^+2\pi^-$

NODE=M074R37
NODE=M074R37

$$\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{56}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<16	90	ABLIKIM	21AW BES3	$e^+e^- \rightarrow 2\pi^+2\pi^-\pi^0$

NODE=M074R38
NODE=M074R38

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{59}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
	¹ ABLIKIM	19AE BES3	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
	² ABLIKIM	19AE BES3	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
	AUBERT	08S BABR	10.6 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M074G4
NODE=M074G4

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.04 ± 0.19 ± 0.09 ¹ ABLIKIM 19AE BES3 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

0.0027 ± 0.0023 ± 0.0001 ² ABLIKIM 19AE BES3 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

OCCUR=2

< 0.5 at 90% CL AUBERT 08S BABR 10.6 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

¹ Solution I of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

NODE=M074G4;LINKAGE=A

² Solution II of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

NODE=M074G4;LINKAGE=B

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{60} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	ABLIKIM 19	BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0$

NODE=M074R31
NODE=M074R31

$$\Gamma(K_S^0 K^\pm \pi^\mp \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{61} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.19	90	ABLIKIM 19	BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \eta$

NODE=M074R32
NODE=M074R32

$$\Gamma(K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{62} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M074G5
NODE=M074G5

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AUBERT 08s	BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$
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$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{63} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<20	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M074R39
NODE=M074R39

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{64} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M074R40
NODE=M074R40

$$\Gamma(K^+ K^+ K^- K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{65} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.8	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow 2K^+ 2K^-$

NODE=M074R41
NODE=M074R41

$$\Gamma(K^+ K^+ K^- K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{66} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow 2K^+ 2K^- \pi^0$

NODE=M074R42
NODE=M074R42

$$\Gamma(p \bar{p} \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{67} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<7.2	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow p \bar{p} \pi^+ \pi^-$

NODE=M074R43
NODE=M074R43

$$\Gamma(p \bar{p} \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{68} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$

NODE=M074R44
NODE=M074R44

$$\Gamma(\Lambda \bar{\Lambda}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{70} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.8 × 10 ⁻³	90	¹ ABLIKIM 21AS	BES3	$e^+ e^- \rightarrow \psi(4260)$

NODE=M074R36
NODE=M074R36

¹ From a measurement of the $e^+ e^- \rightarrow \Lambda \bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M074R36;LINKAGE=A

$$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{71} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<72.4 × 10 ⁻³	90	¹ ABLIKIM 24AH	BES3	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

NODE=M074R69
NODE=M074R69

¹ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M074R69;LINKAGE=A

$$\Gamma(\Xi^0 \bar{\Xi}^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{53} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<40.4 × 10 ⁻³	90	¹ ABLIKIM 24CD	BES3	$e^+ e^- \rightarrow \psi(4230)$

NODE=M074R72
NODE=M074R72

¹ From a fit to $e^+ e^- \rightarrow \Xi^0 \bar{\Xi}^0$ cross sections.

NODE=M074R72;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{54} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<25.1 × 10 ⁻³ (CL = 90%)		[<0.0251 eV (CL = 90%) OUR 2024 BEST LIMIT]		
<25.1 × 10 ⁻³	90	¹ ABLIKIM 23BK	BES3	$e^+ e^- \rightarrow \psi(4230)$

NODE=M074R35
NODE=M074R35

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.7 × 10 ⁻⁴	90	² ABLIKIM 20C	BES3	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
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¹ From a fit to $e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$ cross sections.

NODE=M074R35;LINKAGE=A

² Superseded by ABLIKIM 23BK.

NODE=M074R35;LINKAGE=B

$$\Gamma(pK^-\bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{72}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-3}$	90	¹ ABLIKIM	23BL BES3	$e^+e^- \rightarrow \psi(4230)$

¹ From a fit to $e^+e^- \rightarrow pK^-\bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M074R67
NODE=M074R67

NODE=M074R67;LINKAGE=A

$$\Gamma(\Lambda\bar{\Xi}^+K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{73}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<24.9 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+e^- \rightarrow \Lambda\bar{\Xi}^+K^- + \text{c.c.}$

¹ A fit to the Born cross section of $e^+e^- \rightarrow \Lambda\bar{\Xi}^+K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M074R70
NODE=M074R70

NODE=M074R70;LINKAGE=A

$$\Gamma(\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{74}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+e^- \rightarrow \Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$

¹ A fit to the Born cross section of $e^+e^- \rightarrow \Sigma^0\bar{\Xi}^+K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M074R71
NODE=M074R71

NODE=M074R71;LINKAGE=A

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{77}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G03
NODE=M074G03

NODE=M074G03;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{78}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.0	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G04
NODE=M074G04

NODE=M074G04;LINKAGE=A

$$\psi(4230) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M074245

$$\Gamma(D^0 D^{*(2010)-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{41}/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.42 \times 10^{-6}$	90	¹ PAKHLOVA	09 BELL	$e^+e^- \rightarrow D^0 D^{*-} \pi^+$

¹ Using 4263^{+8}_{-9} MeV for the mass of $\psi(4260)$.

NODE=M074R11
NODE=M074R11

NODE=M074R11;LINKAGE=PA

$\psi(4230)$ BRANCHING RATIOS

NODE=M074225

$$\Gamma(\eta_c(1S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	21B BES3	$e^+e^- \rightarrow \pi^+\pi^-\eta_c$

¹ Not seen in $e^+e^- \rightarrow \pi^+\pi^-\eta_c$ at $\sqrt{s} = 4.226$ GeV with a 90% C.L. upper limit on the cross section of 16.8 pb.

NODE=M074R56
NODE=M074R56

NODE=M074R56;LINKAGE=A

$$\Gamma(\eta_c(1S)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	21B BES3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$

¹ Seen as a peak in the $e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$ cross section with a peak value of $46.1^{+9.5}_{-9.4} \pm 6.6$ pb at $\sqrt{s} = 4.226$ GeV.

NODE=M074R55
NODE=M074R55

NODE=M074R55;LINKAGE=A

$$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

VALUE	DOCUMENT ID	TECN	COMMENT
seen	² ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$

¹ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.

² From a three-resonance fit. Superseded by ABLIKIM 22AM.

NODE=M074R51
NODE=M074R51

NODE=M074R51;LINKAGE=A

NODE=M074R51;LINKAGE=B

$$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-) \quad \Gamma_6/\Gamma_5$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 ± 0.13	¹ LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Systematic uncertainties not estimated.

NODE=M074R02
NODE=M074R02

NODE=M074R02;LINKAGE=LE

$$\Gamma(T_{cc1}(3900)^\pm \pi^\mp, T_{cc1}^\pm \rightarrow J/\psi \pi^\pm) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_7/\Gamma_5$$

VALUE	DOCUMENT ID	TECN	COMMENT
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0.215 ± 0.033 ± 0.075	¹ ABLIKIM	13T	BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.29 ± 0.08	² LIU	13B	BELL $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
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¹ Assuming that the cross section of $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ is fully due to the $\psi(4260)$.

² Systematic error not evaluated.

NODE=M074R01
NODE=M074R01

NODE=M074R01;LINKAGE=AB
NODE=M074R01;LINKAGE=A

$$\Gamma(J/\psi \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	20N	BES3 $e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
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¹ From a fit to the cross section $e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$ at center-of-mass energies between 3.808 and 4.600 GeV.

NODE=M074R50
NODE=M074R50

NODE=M074R50;LINKAGE=A

$$\Gamma(J/\psi K_S^0 K_S^0) / \Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	SHEN	14	BELL 9.4–10.9 $e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$
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NODE=M074R27
NODE=M074R27

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	24T	BES3 $e^+ e^- \rightarrow \eta J/\psi$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	ABLIKIM	200	BES3 $e^+ e^- \rightarrow \eta J/\psi$
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¹ Supersedes ABLIKIM 200.

NODE=M074R52
NODE=M074R52

NODE=M074R52;LINKAGE=A

$$\Gamma(J/\psi \eta \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	15Q	BES3 4.0–4.6 $e^+ e^- \rightarrow J/\psi \eta \pi^0$
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NODE=M074R28
NODE=M074R28

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	17V	BES3 $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
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¹ From a fit to the cross section for $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S) \rightarrow 2(\pi^+ \pi^-) \ell^+ \ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb⁻¹.

NODE=M074R53
NODE=M074R53

NODE=M074R53;LINKAGE=A

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{17}/\Gamma_5$$

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

(0.11 ± 0.03 ± 0.03) to (0.55 ± 0.18 ± 0.19)	¹ ZHANG	17C	RVUE $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
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¹ From a combined fit of BELLE, BABAR and BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ and $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$ data.

NODE=M074R30
NODE=M074R30

NODE=M074R30;LINKAGE=A

$$\Gamma(\chi_{c0} \omega) / \Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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seen	180	¹ ABLIKIM	15C	BES3 $e^+ e^- \rightarrow \omega \chi_{c0}$
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¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+ \pi^-$, $\chi_{c0} \rightarrow K^+ K^-$, and $\omega \rightarrow \pi^+ \pi^- \pi^0$.

NODE=M074R48
NODE=M074R48

NODE=M074R48;LINKAGE=A

$$\Gamma(h_c(1P) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{22}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	ABLIKIM	17G	BES3 $e^+ e^- \rightarrow \pi^+ \pi^- h_c$
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NODE=M074R49
NODE=M074R49

$$\Gamma(h_c(1P) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{22}/\Gamma_5$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.0	90	¹ PEDLAR	11	CLEO $e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$
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¹ At $\sqrt{s} = 4260$ MeV, PEDLAR 11 measures $\sigma(e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-) = 32 \pm 17 \pm 6 \pm 6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M074R25
NODE=M074R25

NODE=M074R25;LINKAGE=PE

$$\Gamma(\phi \eta) / \Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	23BT	BES3 $e^+ e^- \rightarrow \phi \eta$
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NODE=M074R68
NODE=M074R68

$\Gamma(D\bar{D})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{29}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<4.0	90	CRONIN-HEN..09	CLEO	e^+e^-
¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $\psi(4260)$.				

NODE=M074R2
NODE=M074R2

NODE=M074R2;LINKAGE=AU

 $\Gamma(D^0\bar{D}^0)/\Gamma_{total}$ Γ_{30}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen [not seen OUR 2024 BEST LIMIT]			
possibly seen	¹ ABLIKIM	24BH BES3	$e^+e^- \rightarrow D^0\bar{D}^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
¹ A precision measurement of the $e^+e^- \rightarrow D^0\bar{D}^0$ cross section shows complex structure in this mass region.			

NODE=M074R12
NODE=M074R12

NODE=M074R12;LINKAGE=A

 $\Gamma(D^+D^-)/\Gamma_{total}$ Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen [not seen OUR 2024 BEST LIMIT]			
possibly seen	¹ ABLIKIM	24BH BES3	$e^+e^- \rightarrow D^+D^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^+D^-\gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^+D^-\gamma$
¹ A precision measurement of the $e^+e^- \rightarrow D^+D^-$ cross section shows complex structure in this mass region.			

NODE=M074R13
NODE=M074R13

NODE=M074R13;LINKAGE=A

 $\Gamma(D^*\bar{D}+c.c.)/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{32}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<34	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<45	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R03
NODE=M074R03 $\Gamma(D^*(2007)^0\bar{D}^0+c.c.)/\Gamma_{total}$ Γ_{33}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

NODE=M074R14
NODE=M074R14 $\Gamma(D^*(2010)^+D^-+c.c.)/\Gamma_{total}$ Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^-$
not seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M074R15
NODE=M074R15 $\Gamma(D^*\bar{D}^*)/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{35}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	CRONIN-HEN..09	CLEO	e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<40	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}^*$

NODE=M074R04
NODE=M074R04 $\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{total}$ Γ_{36}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

NODE=M074R17
NODE=M074R17

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
not seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M074R18
NODE=M074R18

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.))}/\Gamma_{\text{total}} \quad \Gamma_{39}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$10.6 \delta e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
NODE=M074R16

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)/\Gamma_{\text{total}} \quad \Gamma_{40}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
NODE=M074R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{40}/\Gamma_5$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
NODE=M074R05

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{41}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM 19R	BES3	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$

NODE=M074R54
NODE=M074R54

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$
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$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{41}/\Gamma_5$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D_1(2420) \bar{D} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{42}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 19AR	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$

NODE=M074R33
NODE=M074R33

¹ Results from a measurement of $\sigma(e^+ e^- \rightarrow D_1(2420) \bar{D} + \text{c.c.})$ between $\sqrt{s} = 4.3$ and 4.6 GeV.

NODE=M074R33;LINKAGE=A

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma_{\text{total}} \quad \Gamma_{43}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{43}/\Gamma_5$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}} \quad \Gamma_{45}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M074R19
NODE=M074R19

not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
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$$\Gamma(D_s^+ D_s^-)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{45}/\Gamma_5$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	95	DEL-AMO-SA..10N	BABR	$10.6 e^+ e^-$

NODE=M074R07
NODE=M074R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.3	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
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$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{46}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M074R20
NODE=M074R20

not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
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$$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{46}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 0.8	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<44	95	DEL-AMO-SA..10N	BABR	$10.6 e^+ e^-$

 NODE=M074R08
 NODE=M074R08

$$\Gamma(D_s^{*+} D_s^{*-}) / \Gamma_{\text{total}}$$

 Γ_{47}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

 NODE=M074R21
 NODE=M074R21

$$\Gamma(D_s^{*+} D_s^{*-}) / \Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{47}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 9.5	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	95	DEL-AMO-SA..10N	BABR	$10.6 e^+ e^-$

 NODE=M074R09
 NODE=M074R09

$$\Gamma(p\bar{p}) / \Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{48}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.13	90	¹ AUBERT 06B	BABR	$e^+ e^- \rightarrow p\bar{p}\gamma$

 NODE=M074R1
 NODE=M074R1

¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $\psi(4260)$.

NODE=M074R1;LINKAGE=AU

$$\Gamma(p\bar{p}\pi^0) / \Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{49}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2×10^{-4}	90	ABLIKIM 17F	BES3	$e^+ e^- \rightarrow \psi(4260) \rightarrow$ hadrons

 NODE=M074R00
 NODE=M074R00
 OCCUR=2

$$\Gamma(p\bar{p}\eta) / \Gamma_{\text{total}}$$

 Γ_{50}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21AN	BES3	$e^+ e^- \rightarrow p\bar{p}\eta$

 NODE=M074R45
 NODE=M074R45

$$\Gamma(p\bar{p}\omega) / \Gamma_{\text{total}}$$

 Γ_{52}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21AN	BES3	$e^+ e^- \rightarrow p\bar{p}\omega$

 NODE=M074R46
 NODE=M074R46

$$\Gamma(\omega\pi^0) / \Gamma_{\text{total}}$$

 Γ_{57}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 22K	BES3	$e^+ e^- \rightarrow \omega\pi^0$

 NODE=M074R59
 NODE=M074R59

$$\Gamma(\omega\eta) / \Gamma_{\text{total}}$$

 Γ_{58}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 22K	BES3	$e^+ e^- \rightarrow \omega\eta$

 NODE=M074R60
 NODE=M074R60

$$\Gamma(p\bar{p}p\bar{p}) / \Gamma_{\text{total}}$$

 Γ_{69}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM 21D	BES3	$4.0-4.6 e^+ e^- \rightarrow p\bar{p}p\bar{p}$

 NODE=M074R58
 NODE=M074R58

Radiative decays

$$\Gamma(\eta_c(1S)\gamma) / \Gamma_{\text{total}}$$

 Γ_{75}/Γ

VALUE	DOCUMENT ID	COMMENT
possibly seen	¹ ABLIKIM 17W	$e^+ e^- \rightarrow \gamma\eta_c(1S)$

 NODE=M074R29
 NODE=M074R29

¹ Significance ranges from 4.2σ to as low as 1.5σ for a flat component plus $\psi(4260)$ spectrum. Needs confirmation.

NODE=M074R29;LINKAGE=A

$$\Gamma(\eta_c(1S)\pi^0\gamma) / \Gamma_{\text{total}}$$

 Γ_{76}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 21B	BES3	$e^+ e^- \rightarrow \gamma\pi^0\eta_c$

 NODE=M074R57
 NODE=M074R57

¹ Not seen in $e^+ e^- \rightarrow \gamma\pi^0\eta_c$ at $\sqrt{s} = 4.226$ GeV with a 90% C.L. upper limit on the cross section of 11.2 pb.

NODE=M074R57;LINKAGE=A

$\Gamma(\chi_{c1}(3872)\gamma)/\Gamma_{total}$		Γ_{79}/Γ		
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen		ABLIKIM	19v BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
seen	20 ± 5	ABLIKIM	14 BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

NODE=M074R26
 NODE=M074R26

$\psi(4230)$ REFERENCES

NODE=M074

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24BH	PRL 133 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62924
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
ABLIKIM	24T	PR D109 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62671
ABLIKIM	23AE	PR D108 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62092
ABLIKIM	23AQ	JHEP 2308 159	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62313
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	23BT	PR D108 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62516
ABLIKIM	23R	PR D107 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62062
ABLIKIM	23U	PR D107 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62065
ABLIKIM	23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62072
ABLIKIM	22AM	PR D106 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61885
ABLIKIM	22AU	CP C46 111002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61896
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61441
ABLIKIM	21AN	PR D104 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61446
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	21AW	PR D104 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61479
ABLIKIM	21B	PR D103 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61029
ABLIKIM	21D	PR D103 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61031
ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60210
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60744
ABLIKIM	20C	PRL 124 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60215
ABLIKIM	20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60338
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60344
ABLIKIM	19	PR D99 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59515
ABLIKIM	19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59856
ABLIKIM	19AI	PR D99 091103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59871
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ABLIKIM	19K	PR D99 019903 (errata.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	19R	PRL 122 102002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59765
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59796
ABLIKIM	18N	PR D97 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58914
ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57755
ABLIKIM	17F	PL B771 45	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57909
ABLIKIM	17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57915
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58029
Also		PR D99 019903 (errata.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	17W	PR D96 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58212
GAO	17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan		REFID=57991
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang		REFID=58219
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan		REFID=58463
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15C	PRL 114 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56401
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56782
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55647
SHEN	14	PR D89 072015	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55944
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55409
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=55410
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54750
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53638
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=16787
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53532
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52724
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=53114
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52134
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=52135
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=51960
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT_BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51523
AUBERT_B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50776

$\chi_{c1}(4274)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

was $X(4274)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c1} K^+$, $\chi_{c1} \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 6.0σ .

NODE=M233

NODE=M233

 $\chi_{c1}(4274)$ MASS

NODE=M233M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4286 $^{+8}_{-9}$ OUR AVERAGE		Error includes scale factor of 1.7.		
4294 $\pm 4 \pm \frac{3}{6}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
4274.4 $^{+8.4}_{-6.7} \pm 1.9$	22	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4273.3 $\pm 8.3 \pm \frac{17.2}{3.6}$	4289	^{3,4} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 18σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1σ .				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M233M

NODE=M233M;LINKAGE=C
NODE=M233M;LINKAGE=B
NODE=M233M;LINKAGE=A
NODE=M233M;LINKAGE=D

 $\chi_{c1}(4274)$ WIDTH

NODE=M233W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 7 OUR AVERAGE				
53 $\pm 5 \pm 5$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
32.3 $^{+21.9}_{-15.3} \pm 7.6$	22	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
56 $\pm 11 \pm \frac{8}{11}$	4289	^{3,4} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 18σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1σ .				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M233W

NODE=M233W;LINKAGE=C
NODE=M233W;LINKAGE=B
NODE=M233W;LINKAGE=A
NODE=M233W;LINKAGE=D

 $\chi_{c1}(4274)$ DECAY MODES

NODE=M233215;NODE=M233

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen

DESIG=1

 $\chi_{c1}(4274)$ BRANCHING RATIOS

NODE=M233220

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	4289	^{2,3} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 18σ .				
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0σ .				
³ Superseded by AAIJ 21E.				

NODE=M233R01
NODE=M233R01

NODE=M233R01;LINKAGE=B
NODE=M233R01;LINKAGE=A
NODE=M233R01;LINKAGE=C

 $\chi_{c1}(4274)$ REFERENCES

NODE=M233

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	17	MPL A32 1750139	T. Altonen <i>et al.</i>	(CDF Collab.)

REFID=61150
REFID=57657
REFID=57636
REFID=58161

X(4350)

$$I^G(J^{PC}) = 0^+(?^{?+})$$

OMITTED FROM SUMMARY TABLE

Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.

NODE=M194

NODE=M194

NODE=M194M

NODE=M194M

NODE=M194M;LINKAGE=SH

NODE=M194W

NODE=M194W

NODE=M194W;LINKAGE=SH

NODE=M194215;NODE=M194

DESIG=1

DESIG=2

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

NODE=M194

REFID=53235

X(4350) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4350.6^{+4.6}_{-5.1} \pm 0.7$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

¹ Statistical significance of 3.2 σ .**X(4350) WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

¹ Statistical significance of 3.2 σ .**X(4350) DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

X(4350) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_2\Gamma_1/\Gamma$
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.5^{+0.7}_{-0.6} \pm 0.3$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
-----------------------------	---------------------	-------------------	----	--	--

¹ For $J^P = 0^+$. Statistical significance of 3.2 σ .² For $J^P = 2^+$. Statistical significance of 3.2 σ .

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2**X(4350) BRANCHING RATIOS**

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$	Γ_1/Γ
seen	

¹ Statistical significance of 3.2 σ .NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	Γ_2/Γ
seen	

¹ Statistical significance of 3.2 σ .NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

X(4350) REFERENCESSHEN 10 PRL 104 112004 C.P. Shen *et al.* (BELLE Collab.)

NODE=M194

REFID=53235

$\psi(4360)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4360)$; was $X(4360)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT 07S, WANG 07D, and LEES 14F. See also the review on "Spectroscopy of mesons containing two heavy quarks."

NODE=M181

NODE=M181

 $\psi(4360)$ MASS

NODE=M181M

NODE=M181M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4374 ± 7	OUR AVERAGE	Error includes scale factor of 2.4. See the ideogram below.		
4386 ±13 ±17		¹ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
4371.6 ± 2.5 ± 9.2		² ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^- D^+ D^-$
4298 ±12 ±26		³ ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4390.3 ± 6.0 ± 0.7		⁴ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4371.7 ± 7.5 ± 1.8		⁵ ABLIKIM	21AK BES3	$e^+e^- \rightarrow \gamma \chi_{c2} \rightarrow \gamma \gamma J/\psi$
4391.5 ⁺ ₋ $\frac{6.3}{6.8} \pm 1.0$		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
4347 ± 6 ± 3	279	⁶ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
4340 ±16 ± 9	37	⁷ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4406.9 ±17.2 ± 4.5		⁸ ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^- \chi_{c1} \gamma$
4382.0 ±13.3 ± 1.7		⁹ ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
4320.0 ±10.4 ± 7.0		¹⁰ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4383.8 ± 4.2 ± 0.8		¹¹ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4383.7 ± 2.9 ± 6.2		¹² ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4386.4 ± 2.1 ± 6.4		¹³ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4355 ⁺ ₋ $\frac{9}{10} \pm 9$	74	¹⁴ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
4324 ±24		¹⁵ AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
4361 ± 9 ± 9	47	⁷ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$

¹ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.808\text{--}4.951$ GeV. Supersedes ABLIKIM 20O.

² From a fit to the cross section for $e^+e^- \rightarrow D^+ D^- \pi^+\pi^-$ in the range $\sqrt{s} = 4.190\text{--}4.946$ GeV.

³ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV. Parameters depend on the existence or non-existence of a state near 4.5 GeV.

⁴ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

⁵ From a five-resonance fit to the cross section for $e^+e^- \rightarrow \gamma \gamma J/\psi \rightarrow \gamma \gamma \ell^+ \ell^-$.

⁶ From a two-resonance fit. Supersedes WANG 07D.

⁷ From a two-resonance fit.

⁸ From a fit to the $e^+e^- \rightarrow \pi^+\pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.

⁹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

¹⁰ From a three-resonance fit. Superseded by ABLIKIM 22AM.

¹¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^- \psi(2S) \rightarrow 2(\pi^+\pi^-) \ell^+ \ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.

¹² From a three-resonance fit.

¹³ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$ data.

¹⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

¹⁵ From a single-resonance fit. Systematic errors not estimated.

NODE=M181M;LINKAGE=N

NODE=M181M;LINKAGE=M

NODE=M181M;LINKAGE=L

NODE=M181M;LINKAGE=H

NODE=M181M;LINKAGE=G

NODE=M181M;LINKAGE=A

NODE=M181M;LINKAGE=WA

NODE=M181M;LINKAGE=J

NODE=M181M;LINKAGE=BA

NODE=M181M;LINKAGE=K

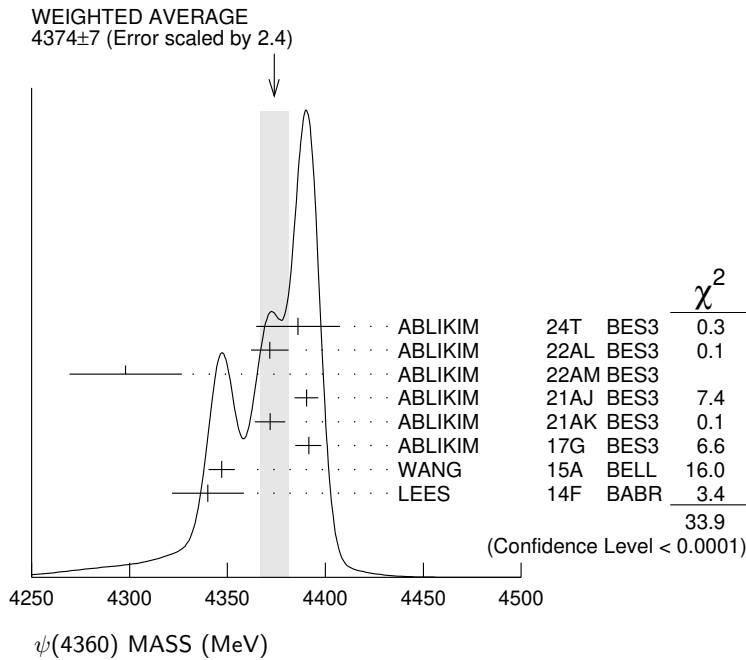
NODE=M181M;LINKAGE=C

NODE=M181M;LINKAGE=E

NODE=M181M;LINKAGE=D

NODE=M181M;LINKAGE=LI

NODE=M181M;LINKAGE=AU



psi(4360) WIDTH

NODE=M181W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
120 ± 12 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
[118 ± 12 MeV OUR 2024 AVERAGE		Scale factor = 2.1]		
177 ± 32 ± 13		1 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
167 ± 4 ± 29		2 ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^- D^+D^-$
127 ± 17 ± 10		3 ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
143.3±10.0± 0.5		4 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
51.1±17.6± 1.9		5 ABLIKIM	21AK BES3	$e^+e^- \rightarrow \gamma\chi_{c2} \rightarrow \gamma\gamma J/\psi$
139.5 ^{+16.2} _{-20.6} ± 0.6		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
103 ± 9 ± 5	279	6 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
94 ± 32 ± 13	37	7 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
128.1±37.2± 2.3		8 ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^- \chi_{c1}\gamma$
135.8±60.8±22.5		9 ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
101.4 ^{+25.3} _{-19.7} ± 10.2		10 ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
84.2±12.5± 2.1		11 ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
94.2± 7.3 ± 2.0		12 ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
96.0± 6.7 ± 2.7		13 ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
103 ⁺¹⁷ ₋₁₅ ± 11	74	14 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
172 ± 33		15 AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
74 ± 15 ± 10	47	7 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$

NODE=M181W
NEW

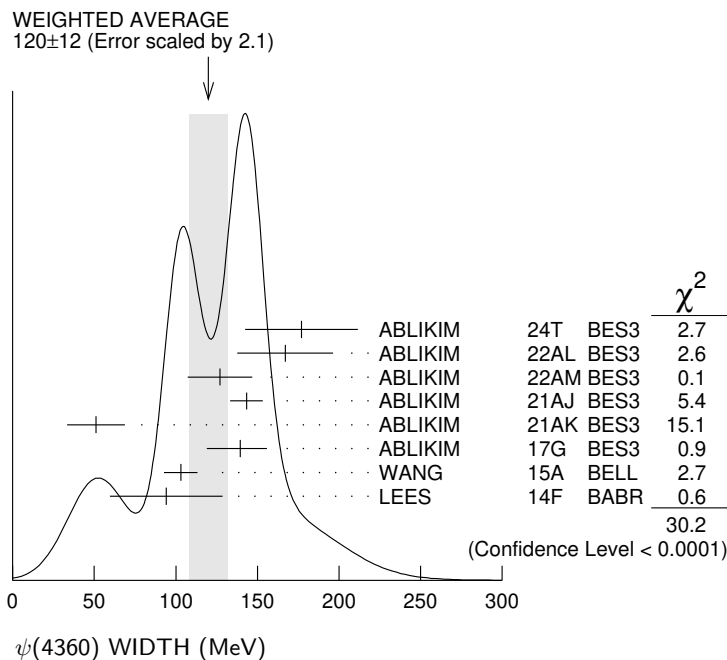
¹ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.808-4.951$ GeV. Supersedes ABLIKIM 200.
² From a fit to the cross section for $e^+e^- \rightarrow D^+D^-\pi^+\pi^-$ in the range $\sqrt{s} = 4.190-4.946$ GeV.
³ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730-4.7008$ GeV. Parameters depend on the existence or non-existence of a state near 4.5 GeV.
⁴ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008-4.698$ GeV.
⁵ From a five-resonance fit to the cross section for $e^+e^- \rightarrow \gamma\gamma J/\psi \rightarrow \gamma\gamma\ell^+\ell^-$.
⁶ From a two-resonance fit. Supersedes WANG 07D.
⁷ From a two-resonance fit.
⁸ From a fit to the $e^+e^- \rightarrow \pi^+\pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.
⁹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808-4.600$ GeV.
¹⁰ From a three-resonance fit. Superseded by ABLIKIM 22AM.
¹¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^- \psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.

NODE=M181W;LINKAGE=M
 NODE=M181W;LINKAGE=L
 NODE=M181W;LINKAGE=K
 NODE=M181W;LINKAGE=G
 NODE=M181W;LINKAGE=F
 NODE=M181W;LINKAGE=A
 NODE=M181W;LINKAGE=WA
 NODE=M181W;LINKAGE=I
 NODE=M181W;LINKAGE=BA
 NODE=M181W;LINKAGE=J
 NODE=M181W;LINKAGE=C

- 12 From a three-resonance fit.
- 13 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- 14 From a combined fit of AUBERT 07S and WANG 07D data with two resonances.
- 15 From a single-resonance fit. Systematic errors not estimated.

NODE=M181W;LINKAGE=E
 NODE=M181W;LINKAGE=D

NODE=M181W;LINKAGE=LI
 NODE=M181W;LINKAGE=AU



ψ(4360) DECAY MODES

NODE=M181215;NODE=M181

Mode	Fraction (Γ_i/Γ)
Γ ₁ e^+e^-	seen
Γ ₂ $h_c\pi^+\pi^-$	seen
Γ ₃ $J/\psi\pi^+\pi^-$	seen
Γ ₄ $\psi(2S)\pi^+\pi^-$	seen
Γ ₅ $\psi(3770)\pi^+\pi^-$	possibly seen
Γ ₆ $\psi_2(3823)\pi^+\pi^-$	seen
Γ ₇ $J/\psi\eta$	seen
Γ ₈ $D^0D^{*-}\pi^+$	not seen
Γ ₉ $D^+D^-\pi^+\pi^-$	seen
Γ ₁₀ $D_1(2420)\bar{D} + c.c.$	possibly seen
Γ ₁₁ $\phi\eta$	not seen
Γ ₁₂ $\omega\pi^0$	not seen
Γ ₁₃ $\omega\eta$	not seen
Γ ₁₄ $\rho\bar{\rho}\eta$	not seen
Γ ₁₅ $\rho\bar{\rho}\omega$	not seen
Γ ₁₆ $\chi_{c1}\gamma$	not seen
Γ ₁₇ $\chi_{c2}\gamma$	not seen
Γ ₁₈ $\Sigma^+\bar{\Sigma}^-$	not seen
Γ ₁₉ $\Xi^0\bar{\Xi}^0$	
Γ ₂₀ $\Xi^-\bar{\Xi}^+$	not seen
Γ ₂₁ $\rho K^-\bar{\Lambda} + c.c.$	not seen
Γ ₂₂ $\Lambda\bar{\Xi}^+K^- + c.c.$	not seen
Γ ₂₃ $\Sigma^0\bar{\Xi}^+K^- + c.c.$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=12
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=2
 DESIG=11
 DESIG=5
 DESIG=4
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=17
 DESIG=10
 DESIG=20
 DESIG=15
 DESIG=16
 DESIG=13
 DESIG=14
 DESIG=6;OUR EVAL;→ UNCHECKED ←
 DESIG=7;OUR EVAL;→ UNCHECKED ←
 DESIG=21;OUR EVAL;→ UNCHECKED ←
 DESIG=24
 DESIG=18;OUR EVAL;→ UNCHECKED ←
 DESIG=19;OUR EVAL;→ UNCHECKED ←
 DESIG=22;OUR EVAL;→ UNCHECKED ←
 DESIG=23;OUR EVAL;→ UNCHECKED ←

ψ(4360) $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M181230

$\Gamma(h_c\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$		
VALUE (eV)	DOCUMENT ID	TECN	COMMENT
11.6^{+5.0}_{-4.4} ± 1.9	ABLIKIM	17G	BES3 $e^+e^- \rightarrow \pi^+\pi^-h_c$

NODE=M181R11
 NODE=M181R11

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
10.7±4.1		1 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
20.7±2.5		2 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
9.9±4.1		3 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
19.4±2.0		4 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
7.3±2.8		5 ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
11.0±3.8		6 ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
9.2±0.6±0.6	279	7 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.9±0.6±0.7	279	8 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
6.0±1.0±0.5	37	5 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
7.2±1.0±0.6	37	6 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.1 ^{+1.3} _{-1.2}	74	9 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
12.3±1.2	74	10 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.4±1.7±1.5	47	5 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.8±1.8±1.4	47	6 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

NODE=M181G1
 NODE=M181G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.7±4.1		1 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	
20.7±2.5		2 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	OCCUR=2
9.9±4.1		3 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	OCCUR=3
19.4±2.0		4 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	OCCUR=4
7.3±2.8		5 ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	
11.0±3.8		6 ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$	OCCUR=2
9.2±0.6±0.6	279	7 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
10.9±0.6±0.7	279	8 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
6.0±1.0±0.5	37	5 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
7.2±1.0±0.6	37	6 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
11.1 ^{+1.3} _{-1.2}	74	9 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
12.3±1.2	74	10 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
10.4±1.7±1.5	47	5 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	
11.8±1.8±1.4	47	6 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Solution I of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

NODE=M181G1;LINKAGE=E

² Solution II of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

NODE=M181G1;LINKAGE=F

³ Solution III of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

NODE=M181G1;LINKAGE=G

⁴ Solution IV of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

NODE=M181G1;LINKAGE=H

⁵ Solution I of two equivalent solutions in a fit using two interfering resonances.

NODE=M181G1;LINKAGE=WA

⁶ Solution II of two equivalent solutions in a fit using two interfering resonances.

NODE=M181G1;LINKAGE=WN

⁷ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.

NODE=M181G1;LINKAGE=A

⁸ Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.

NODE=M181G1;LINKAGE=B

⁹ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M181G1;LINKAGE=LI

¹⁰ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M181G1;LINKAGE=LU

 $\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
1.8±0.6±0.3		1 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
2.1±0.7±0.3		2 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
4.3±1.3±0.5		3 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
5.0±1.5±0.5		4 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
3.4±2.2		5 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.5±1.0		6 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.7±1.1		7 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
<6.8	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\eta$

NODE=M181G01
 NODE=M181G01

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.8±0.6±0.3		1 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$	
2.1±0.7±0.3		2 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$	OCCUR=2
4.3±1.3±0.5		3 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$	OCCUR=3
5.0±1.5±0.5		4 ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$	OCCUR=4
3.4±2.2		5 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$	
1.5±1.0		6 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$	OCCUR=2
1.7±1.1		7 ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$	OCCUR=3
<6.8	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\eta$	

NODE=M181G01;LINKAGE=D

NODE=M181G01;LINKAGE=E

NODE=M181G01;LINKAGE=F

NODE=M181G01;LINKAGE=G

NODE=M181G01;LINKAGE=A

NODE=M181G01;LINKAGE=B

NODE=M181G01;LINKAGE=C

¹ Solution 1 of 4. Supersedes ABLIKIM 200.

² Solution 2 of 4. Supersedes ABLIKIM 200.

³ Solution 3 of 4. Supersedes ABLIKIM 200.

⁴ Solution 4 of 4. Supersedes ABLIKIM 200.

⁵ Solution 1 of three equivalent fit solutions using three resonant structures.

⁶ Solution 2 of three equivalent fit solutions using three resonant structures.

⁷ Solution 3 of three equivalent fit solutions using three resonant structures.

 $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.57	90	1 HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

NODE=M181G02
 NODE=M181G02

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M181G02;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	1 HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M181G03
 NODE=M181G03

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M181G03;LINKAGE=A

$$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{18} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<118.8 \times 10^{-3}$	90	¹ ABLIKIM	24AH BES3	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

NODE=M181R19
NODE=M181R19

¹ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M181R19;LINKAGE=A

$$\Gamma(\Xi^0 \bar{\Xi}^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<84.5 \times 10^{-3}$	90	¹ ABLIKIM	24CD BES3	$e^+ e^- \rightarrow \psi(4360)$

NODE=M181R22
NODE=M181R22

¹ From a fit to $e^+ e^- \rightarrow \Xi^0 \bar{\Xi}^0$ cross sections.

NODE=M181R22;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{20} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<44.8 \times 10^{-3}$ (CL = 90%)		[<0.0448 eV (CL = 90%) OUR 2024 BEST LIMIT]		
$<44.8 \times 10^{-3}$	90	¹ ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(4360)$

NODE=M181R15
NODE=M181R15

¹ From a fit to $e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$ cross sections.

NODE=M181R15;LINKAGE=A

$$\Gamma(p K^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{21} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<4.7 \times 10^{-3}$	90	¹ ABLIKIM	23BL BES3	$e^+ e^- \rightarrow \psi(4360)$

NODE=M181R17
NODE=M181R17

¹ From a fit to $e^+ e^- \rightarrow p K^- \bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M181R17;LINKAGE=A

$$\Gamma(\Lambda \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{22} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<35.8 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$

NODE=M181R20
NODE=M181R20

¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Lambda \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M181R20;LINKAGE=A

$$\Gamma(\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{23} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-3}$	90	¹ ABLIKIM	24AL BES3	$e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$

NODE=M181R21
NODE=M181R21

¹ A fit to the Born cross section of $e^+ e^- \rightarrow \Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}$ including interference with the continuum. Two solutions from the fit.

NODE=M181R21;LINKAGE=A

$\psi(4360)$ BRANCHING RATIOS

NODE=M181225

$$\Gamma(h_c \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	17G BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M181R08
NODE=M181R08

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	17V BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$

NODE=M181R00
NODE=M181R00

¹ From a fit to the cross section for $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S) \rightarrow 2(\pi^+ \pi^-) \ell^+ \ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .

NODE=M181R00;LINKAGE=A

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_4 / \Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M181R04
NODE=M181R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

($0.81 \pm 0.12 \pm 0.13$) to ($42 \pm 15 \pm 15$)	¹ ZHANG	17C RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
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¹ From a combined fit of BELLE, BABAR and BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ and $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$ data.

NODE=M181R04;LINKAGE=A

$$\Gamma(\psi(3770) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	¹ ABLIKIM	19AR BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$

NODE=M181R06
NODE=M181R06

¹ Observe $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3770)$ at $\sqrt{s} = 4.26, 4.36, \text{ and } 4.42 \text{ GeV}$ but cannot establish if continuum or resonant.

NODE=M181R06;LINKAGE=A

$\Gamma(\psi_2(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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seen		¹ ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	19	² ABLIKIM	15S BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
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¹ From a fit to the $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances.

² From a fit of $e^+e^- \rightarrow \pi^+\pi^-\psi_2(3823)$, $\psi_2(3823) \rightarrow \chi_{c1}\gamma$ cross sections taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4360)$ line shape.

NODE=M181R03
NODE=M181R03

NODE=M181R03;LINKAGE=C

NODE=M181R03;LINKAGE=A

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	24T BES3	$e^+e^- \rightarrow \eta J/\psi$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	² ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
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¹ Supersedes ABLIKIM 200.

² With a significance of 6.0 σ .

NODE=M181R07
NODE=M181R07

NODE=M181R07;LINKAGE=B
NODE=M181R07;LINKAGE=A

 $\Gamma(D^0 D^{*-}\pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma \times \Gamma_1/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$<0.72 \times 10^{-6}$	90	¹ PAKHLOVA	09 BELL	$e^+e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-}\pi^+$
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¹ Using $4355_{-10}^{+9} \pm 9$ MeV for the mass of $\psi(4360)$.

NODE=M181R02
NODE=M181R02

NODE=M181R02;LINKAGE=PA

 $\Gamma(D^0 D^{*-}\pi^+)/\Gamma(\psi(2S)\pi^+\pi^-)$ Γ_8/Γ_4

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<8	90	PAKHLOVA	09 BELL	$e^+e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-}\pi^+$
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NODE=M181R01
NODE=M181R01

 $\Gamma(D^+ D^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	¹ ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^- D^+ D^-$
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¹ From a fit to the cross section for $e^+e^- \rightarrow D^+ D^- \pi^+ \pi^-$ in the range $\sqrt{s} = 4.190\text{--}4.946$ GeV.

NODE=M181R14
NODE=M181R14

NODE=M181R14;LINKAGE=A

 $\Gamma(D_1(2420)\bar{D} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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possibly seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^- D\bar{D}$
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¹ Evidence for $e^+e^- \rightarrow D_1(2420)\bar{D} + \text{c.c.}$ between $\sqrt{s} = 4.3$ and 4.6 GeV, not necessarily resonant.

NODE=M181R05
NODE=M181R05

NODE=M181R05;LINKAGE=A

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	23BT BES3	$e^+e^- \rightarrow \phi\eta$
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NODE=M181R18
NODE=M181R18

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\pi^0$
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NODE=M181R12
NODE=M181R12

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\eta$
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NODE=M181R13
NODE=M181R13

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	21AN BES3	$e^+e^- \rightarrow p\bar{p}\eta$
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NODE=M181R09
NODE=M181R09

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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not seen	ABLIKIM	21AN BES3	$e^+e^- \rightarrow p\bar{p}\omega$
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NODE=M181R10
NODE=M181R10

$\psi(4360)$ REFERENCES

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
ABLIKIM	24T	PR D109 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62671
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	23BT	PR D108 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62516
ABLIKIM	22AL	PR D106 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61884
ABLIKIM	22AM	PR D106 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61885
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61664
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61441
ABLIKIM	21AK	PR D104 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61443
ABLIKIM	21AN	PR D104 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61446
ABLIKIM	200	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60344
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ABLIKIM	19K	PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57755
ABLIKIM	17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57915
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58029
Also		PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang		REFID=58219
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan		REFID=58463
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56784
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=56839
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55938
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959

NODE=M181

REFID=62688
REFID=62693
REFID=63037
REFID=62671
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REFID=59611
REFID=57755
REFID=57915
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REFID=59611
REFID=58219
REFID=58463
REFID=56784
REFID=56816
REFID=56839
REFID=55938
REFID=55377
REFID=53143
REFID=52296
REFID=51724
REFID=51959

 $\psi(4415)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M073

 $\psi(4415)$ MASS

NODE=M073M

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
4415 ± 5 OUR AVERAGE				
4413.6 ± 9.0 ± 0.8	¹	ABLIKIM 24D	BES3	$e^+e^- \rightarrow \omega\gamma J/\psi$
4414.6 ± 3.4 ± 6.1		ABLIKIM 23BH	BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
4415.1 ± 7.9	²	ABLIKIM 08D	BES2	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4412 ± 15	³	MO	10	RVUE $e^+e^- \rightarrow \text{hadrons}$
4411 ± 7	⁴	PAKHLOVA 08A	BELL	10.6 $e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	⁵	SETH 05A	RVUE	$e^+e^- \rightarrow \text{hadrons}$
4429 ± 9	⁶	SETH 05A	RVUE	$e^+e^- \rightarrow \text{hadrons}$
4417 ± 10		BRANDELIK 78C	DASP	e^+e^-
4414 ± 7		SIEGRIST 76	MRK1	e^+e^-

NODE=M073M

OCCUR=2

¹ Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \rightarrow \gamma J/\psi$).

² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

³ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

⁴ Systematic uncertainties not estimated.

⁵ From a fit to Crystal Ball (OSTERHELD 86) data.

⁶ From a fit to BES (BAI 02C) data.

NODE=M073M;LINKAGE=A
NODE=M073M;LINKAGE=AB

NODE=M073M;LINKAGE=MO

NODE=M073M;LINKAGE=NS
NODE=M073M;LINKAGE=ST
NODE=M073M;LINKAGE=SE

 $\psi(4415)$ WIDTH

NODE=M073W

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
110 ± 13 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
[110 ± 22 MeV OUR 2024 AVERAGE Scale factor = 2.3]				
110.5 ± 15.0 ± 2.9	⁷	ABLIKIM 24D	BES3	$e^+e^- \rightarrow \omega\gamma J/\psi$
122.5 ± 7.5 ± 8.1		ABLIKIM 23BH	BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
71.5 ± 19.0	⁸	ABLIKIM 08D	BES2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M073W

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

118 ±32	⁹ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
77 ±20	¹⁰ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 ±16	¹¹ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
118 ±35	¹² SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
66 ±15	BRANDELIK	78C DASP	e^+e^-
33 ±10	SIEGRIST	76 MRK1	e^+e^-

OCCUR=2

⁷ Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \rightarrow \gamma J/\psi$).

NODE=M073W;LINKAGE=A
NODE=M073W;LINKAGE=AB

⁸ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

⁹ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8-4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.

NODE=M073W;LINKAGE=MO

¹⁰ Systematic uncertainties not estimated.

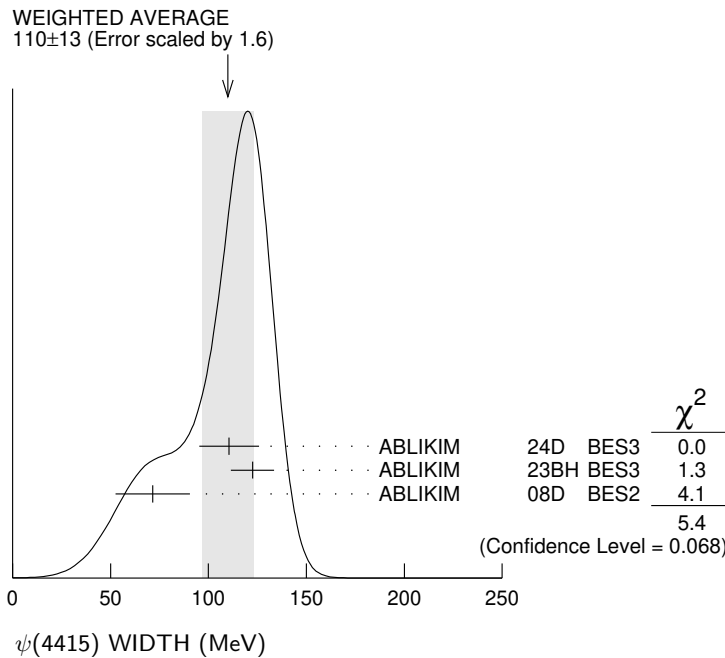
NODE=M073W;LINKAGE=NS

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M073W;LINKAGE=ST

¹² From a fit to BES (BAI 02C) data.

NODE=M073W;LINKAGE=SE



$\psi(4415)$ DECAY MODES

NODE=M073215;NODE=M073

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

NODE=M073

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D\bar{D}$	seen	
Γ_2 $D^0\bar{D}^0$	seen	
Γ_3 D^+D^-	seen	
Γ_4 $D^*\bar{D} + \text{c.c.}$	seen	
Γ_5 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
Γ_6 $D^*(2010)^+D^- + \text{c.c.}$	seen	
Γ_7 $D^*\bar{D}^*$	seen	
Γ_8 $D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	seen	
Γ_9 $D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen	
Γ_{10} $D^0D^-\pi^+$ (excl. $D^*(2010)^+D^-$ + c.c.)	< 2.3 %	90%
Γ_{11} $D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.}$	(10 ± 4) %	
Γ_{12} $D^0D^{*-}\pi^+ + \text{c.c.}$	< 31 %	90%
Γ_{13} $D_1(2420)\bar{D} + \text{c.c.}$	possibly seen	
Γ_{14} $D_s^+D_s^-$	not seen	

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8

DESIG=9

DESIG=10;OUR EVAL;→ UNCHECKED ←

DESIG=11

DESIG=12

DESIG=13;OUR EVAL;→ UNCHECKED ←

DESIG=14

DESIG=15

DESIG=4

DESIG=5

DESIG=6

DESIG=25

DESIG=16

Γ_{15}	$\omega\chi_{c2}$	$(9 \pm 4) \times 10^{-3}$		DESIG=20	
Γ_{16}	$D_s^{*+} D_s^- + c.c.$	seen		DESIG=17	
Γ_{17}	$D_s^{*+} D_s^{*-}$	seen		DESIG=18	
Γ_{18}	$\psi_2(3823)\pi^+\pi^-$	possibly seen		DESIG=21	
Γ_{19}	$\psi(3770)\pi^+\pi^-$	possibly seen		DESIG=24	
Γ_{20}	$J/\psi\eta$	< 1.0	%	90%	DESIG=19
Γ_{21}	$\chi_{c1}\gamma$	< 1.3	$\times 10^{-3}$	90%	DESIG=22
Γ_{22}	$\chi_{c2}\gamma$	< 7	$\times 10^{-3}$	90%	DESIG=23
Γ_{23}	$\Lambda\bar{\Lambda}$	< 5	$\times 10^{-6}$	90%	DESIG=27
Γ_{24}	$\Sigma^+\bar{\Sigma}^-$	< 1.8	$\times 10^{-4}$	90%	DESIG=32
Γ_{25}	$\Xi^0\bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	90%	DESIG=35
Γ_{26}	$\Xi^-\bar{\Xi}^+$	< 6	$\times 10^{-5}$	90%	DESIG=30
Γ_{27}	$pK^-\bar{\Lambda} + c.c.$	< 1.0	$\times 10^{-5}$	90%	DESIG=31
Γ_{28}	$\Lambda\bar{\Xi}^+ K^- + c.c.$	< 4	$\times 10^{-5}$	90%	DESIG=33
Γ_{29}	$\Sigma^0\bar{\Xi}^+ K^- + c.c.$	< 2.5	$\times 10^{-4}$	90%	DESIG=34
Γ_{30}	$\omega\pi^0$	not seen			DESIG=28
Γ_{31}	$\omega\eta$	not seen			DESIG=29
Γ_{32}	e^+e^-	$(3.2 \pm 1.2) \times 10^{-6}$			DESIG=1
Γ_{33}	$\mu^+\mu^-$	$(1.1 \pm 0.4) \times 10^{-5}$			DESIG=26

 $\psi(4415)$ PARTIAL WIDTHS

NODE=M073220

 $\Gamma(e^+e^-)$ **Γ_{32}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.35±0.12	13 ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.4 to 0.8	14 MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
0.72±0.11	15 SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
0.64±0.23	16 SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
0.49±0.13	BRANDELIK	78C DASP	e^+e^-
0.44±0.14	SIEGRIST	76 MRK1	e^+e^-

NODE=M073W1
NODE=M073W1

OCCUR=2

¹³ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

NODE=M073W1;LINKAGE=AB

¹⁴ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.

NODE=M073W1;LINKAGE=MO

¹⁵ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M073W1;LINKAGE=ST

¹⁶ From a fit to BES (BAI 02C) data.

NODE=M073W1;LINKAGE=SE

 $\Gamma(\mu^+\mu^-)$ **Γ_{33}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.25±0.28±0.35	17,18 ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M073W2
NODE=M073W2

¹⁷ From a fit to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+\mu^-) = \Gamma(e^+e^-)$.

NODE=M073W2;LINKAGE=A

¹⁸ From solution 1 of 8 with equal fit quality. Other solutions range from $1.24 \pm 0.28 \pm 0.35$ to $1.27 \pm 0.41 \pm 0.36$ keV.

NODE=M073W2;LINKAGE=B

 $\psi(4415) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M073230

 $\Gamma(\omega\chi_{c2}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{15}\Gamma_{32}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
3.17±0.39±0.24	19 ABLIKIM	24D BES3	$e^+e^- \rightarrow \omega\gamma J/\psi$

NODE=M073R22
NODE=M073R22

¹⁹ Assuming one single Breit-Wigner resonance in $\omega\chi_{c2}(1P)$ ($\chi_{c2} \rightarrow \gamma J/\psi$).

NODE=M073R22;LINKAGE=A

 $\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{20}\Gamma_{32}/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.6	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M073G01
NODE=M073G01

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	²⁰ HAN	15	BELL 10.58 e ⁺ e ⁻ → χ _{c1} γ

²⁰ Using B(η → γγ) = (39.41 ± 0.21)%.

NODE=M073G02
NODE=M073G02

NODE=M073G02;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	²¹ HAN	15	BELL 10.58 e ⁺ e ⁻ → χ _{c2} γ

²¹ Using B(η → γγ) = (39.41 ± 0.21)%.

NODE=M073G03
NODE=M073G03

NODE=M073G03;LINKAGE=A

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.8 × 10 ⁻³	90	²² ABLIKIM	21AS	BES3 e ⁺ e ⁻ → ψ(4415)

²² From a measurement of the e⁺e⁻ → ΛΛ̄ cross section between 3.5 and 4.6 GeV.

NODE=M073R16
NODE=M073R16

NODE=M073R16;LINKAGE=A

$$\Gamma(\Sigma^+\bar{\Sigma}^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<62.1 × 10 ⁻³	90	²³ ABLIKIM	24AH	BES3 e ⁺ e ⁻ → Σ ⁺ Σ ⁻

²³ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M073R23
NODE=M073R23

NODE=M073R23;LINKAGE=A

$$\Gamma(\Xi^0\bar{\Xi}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<48.0 × 10 ⁻³	90	²⁴ ABLIKIM	24CD	BES3 e ⁺ e ⁻ → ψ(4415)

²⁴ From a fit to e⁺e⁻ → Ξ⁰Ξ⁰ cross sections.

NODE=M073R26
NODE=M073R26

NODE=M073R26;LINKAGE=A

$$\Gamma(\Xi^-\bar{\Xi}^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<21.7 × 10 ⁻³ (CL = 90%)				[<0.0217 eV (CL = 90%) OUR 2024 BEST LIMIT]
<21.7 × 10 ⁻³	90	²⁵ ABLIKIM	23BK	BES3 e ⁺ e ⁻ → ψ(4415)

²⁵ From a fit to e⁺e⁻ → Ξ⁻Ξ⁺ cross sections.

NODE=M073R19
NODE=M073R19

NODE=M073R19;LINKAGE=A

$$\Gamma(pK^-\bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{27}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.4 × 10 ⁻³	90	²⁶ ABLIKIM	23BL	BES3 e ⁺ e ⁻ → ψ(4415)

²⁶ From a fit to e⁺e⁻ → pK⁻Λ̄ + c.c. cross sections.

NODE=M073R21
NODE=M073R21

NODE=M073R21;LINKAGE=A

$$\Gamma(\Lambda\bar{\Xi}^+K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<14.3 × 10 ⁻³	90	²⁷ ABLIKIM	24AL	BES3 e ⁺ e ⁻ → ΛΞ ⁺ K ⁻ + c.c.

²⁷ A fit to the Born cross section of e⁺e⁻ → ΛΞ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M073R24
NODE=M073R24

NODE=M073R24;LINKAGE=A

$$\Gamma(\Sigma^0\bar{\Xi}^+K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{29}\Gamma_{32}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<87.0 × 10 ⁻³	90	²⁸ ABLIKIM	24AL	BES3 e ⁺ e ⁻ → Σ ⁰ Ξ ⁺ K ⁻ + c.c.

²⁸ A fit to the Born cross section of e⁺e⁻ → Σ⁰Ξ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M073R25
NODE=M073R25

NODE=M073R25;LINKAGE=A

$$\psi(4415) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M073235

$$\Gamma(D^0D^{*-}\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma \times \Gamma_{32}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99 × 10 ⁻⁶	90	²⁹ PAKHLOVA	09	BELL e ⁺ e ⁻ → D ⁰ D ^{*-} π ⁺

²⁹ Using 4421 ± 4 MeV for the mass of ψ(4415).

NODE=M073R01
NODE=M073R01

NODE=M073R01;LINKAGE=PA

ψ(4415) BRANCHING RATIOS

NODE=M073225

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	³⁰ ABLIKIM	24BH	BES3 $e^+e^- \rightarrow D^0\bar{D}^0$	
seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^0\bar{D}^0\gamma$	
not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^0\bar{D}^0\gamma$	

NODE=M073R04
NODE=M073R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

³⁰ A precision measurement of the $e^+e^- \rightarrow D^0\bar{D}^0$ cross section shows complex structure in this mass region.

NODE=M073R04;LINKAGE=A

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen	³¹ ABLIKIM	24BH	BES3 $e^+e^- \rightarrow D^+D^-$	
seen	PAKHLOVA	08	BELL $e^+e^- \rightarrow D^+D^-\gamma$	
not seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^+D^-\gamma$	

NODE=M073R05
NODE=M073R05

• • • We do not use the following data for averages, fits, limits, etc. • • •

³¹ A precision measurement of the $e^+e^- \rightarrow D^+D^-$ cross section shows complex structure in this mass region.

NODE=M073R05;LINKAGE=A

 $\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$	

NODE=M073R06
NODE=M073R06

 $\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
seen	³² ZHUKOVA	18	BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$	
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*+}D^-\gamma$	
seen	PAKHLOVA	07	BELL $e^+e^- \rightarrow D^{*+}D^-\gamma$	

NODE=M073R07
NODE=M073R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

³² Supersedes PAKHLOVA 07.

NODE=M073R07;LINKAGE=A

 $\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ_7
0.14±0.12±0.03	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$	

NODE=M073R02
NODE=M073R02

 $\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_7
0.17±0.25±0.03	AUBERT	09M	BABR $e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$	

NODE=M073R03
NODE=M073R03

 $\Gamma(D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$	

NODE=M073R08
NODE=M073R08

 $\Gamma(D^*(2010)^+D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ
seen	³³ ZHUKOVA	18	BELL $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$	
seen	AUBERT	09M	BABR $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$	
seen	PAKHLOVA	07	BELL $e^+e^- \rightarrow D^{*+}D^{*-}\gamma$	

NODE=M073R09
NODE=M073R09

• • • We do not use the following data for averages, fits, limits, etc. • • •

³³ Supersedes PAKHLOVA 07.

NODE=M073R09;LINKAGE=A

 $\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	Γ_{11}/Γ
10.5±2.4±3.8	³⁴ PAKHLOVA	08A	BELL 10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$	

NODE=M073R3
NODE=M073R3

³⁴ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R3;LINKAGE=PA

 $\Gamma(D^0D^-\pi^+ (\text{excl. } D^*(2010)^+D^- + \text{c.c.})/\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{10}/Γ_{11}
<0.22	90	³⁵ PAKHLOVA	08A	BELL 10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$	

NODE=M073R4
NODE=M073R4

³⁵ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R4;LINKAGE=PA

$\Gamma(D_1(2420)\bar{D} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	36 ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$

NODE=M073R15
 NODE=M073R15

³⁶ Evidence for $e^+e^- \rightarrow D_1(2420)\bar{D} + \text{c.c.}$ between $\sqrt{s} = 4.3$ and 4.6 GeV, not necessarily resonant.

NODE=M073R15;LINKAGE=A

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M073R10
 NODE=M073R10

 $\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M073R11
 NODE=M073R11

 $\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

NODE=M073R12
 NODE=M073R12

 $\Gamma(\psi_2(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	19	37 ABLIKIM	15S BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$

NODE=M073R13
 NODE=M073R13

³⁷ From a fit of $e^+e^- \rightarrow \pi^+\pi^-\psi_2(3823)$, $\psi_2(3823) \rightarrow \chi_{c1}\gamma$ cross sections taken at \sqrt{s} values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4415)$ line shape.

NODE=M073R13;LINKAGE=A

 $\Gamma(\psi(3770)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	38 ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$

NODE=M073R14
 NODE=M073R14

³⁸ Observe $e^+e^- \rightarrow \pi^+\pi^-\psi(3770)$ at $\sqrt{s} = 4.26, 4.36,$ and 4.42 GeV but cannot establish if continuum or resonant.

NODE=M073R14;LINKAGE=A

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\pi^0$

NODE=M073R17
 NODE=M073R17

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\eta$

NODE=M073R18
 NODE=M073R18

 $\psi(4415)$ REFERENCES

NODE=M073

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24BH	PRL 133 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62924
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
ABLIKIM	24D	PRL 132 161901	M. Ablikim <i>et al.</i>	(BESIII)	REFID=62653
ABLIKIM	23BH	PRL 131 151903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62433
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	20AG	PR D82 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60744
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)	REFID=58710
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56784
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53638
DEL-AMO-SA...10N	MO	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53532
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)	REFID=53540
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52724
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52134
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
SETH	05A	PR D72 017501	K.K. Seth		REFID=50813
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)	REFID=51064
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22232
SIEGRIST	76	PRL 36 700	J.L. Siegrist <i>et al.</i>	(LBL, SLAC)	REFID=22243

$\chi_{c0}(4500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE
was $X(4500)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c0} K^+$, $\chi_{c0} \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 6.1σ .

NODE=M234

NODE=M234

 $\chi_{c0}(4500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4474 \pm 3 \pm 3$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$4506 \pm 11^{+12}_{-15}$	4289	^{2,3} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234M

NODE=M234M

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 20σ .
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .
³ Superseded by AAIJ 21E.

NODE=M234M;LINKAGE=B

NODE=M234M;LINKAGE=A

NODE=M234M;LINKAGE=C

 $\chi_{c0}(4500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$77 \pm 6^{+10}_{-8}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$92 \pm 21^{+21}_{-20}$	4289	^{2,3} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234W

NODE=M234W

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 20σ .
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .
³ Superseded by AAIJ 21E.

NODE=M234W;LINKAGE=B

NODE=M234W;LINKAGE=A

NODE=M234W;LINKAGE=C

 $\chi_{c0}(4500)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen

NODE=M234215;NODE=M234

DESIG=1

 $\chi_{c0}(4500)$ BRANCHING RATIOS

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
seen	4289	^{2,3} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234220

NODE=M234R01

NODE=M234R01

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 20σ .
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .
³ Superseded by AAIJ 21E.

NODE=M234R01;LINKAGE=B

NODE=M234R01;LINKAGE=A

NODE=M234R01;LINKAGE=C

 $\chi_{c0}(4500)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=57657
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57636

NODE=M234

X(4630)

$$I^G(J^{PC}) = 0^+(?^{?+})$$

NODE=M262

OMITTED FROM SUMMARY TABLE

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M262

Seen by AAIJ 21E in $B^+ \rightarrow X(4630)K^+$ with $X(4630) \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 5.5σ . The $J^P = 1^-$ assignment is favored over 2^- with a significance of 3σ and other assignments are disfavored by more than 5σ .

X(4630) MASS

NODE=M262M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4626 \pm 16^{+18}_{-110}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M262M

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.5σ .

NODE=M262M;LINKAGE=A

X(4630) WIDTH

NODE=M262W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$174 \pm 27^{+134}_{-73}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M262W

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.5σ .

NODE=M262W;LINKAGE=A

X(4630) DECAY MODES

NODE=M262215;NODE=M262

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen

DESIG=1

X(4630) BRANCHING RATIOS

NODE=M262225

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$	

NODE=M262R01
NODE=M262R01

¹From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.5σ .

NODE=M262R01;LINKAGE=A

X(4630) REFERENCES

NODE=M262

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
------	-----	----------------	-----------------------	----------------

REFID=61150

$\psi(4660)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4660)$; was $X(4660)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by WANG 07D. Also obtained in a combined fit of WANG 07D, AUBERT 07S, and LEES 14F. See also the review on "Spectroscopy of mesons containing two heavy quarks."

NODE=M189

NODE=M189

 $\psi(4660)$ MASS

NODE=M189M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4623 ± 10		OUR AVERAGE		Error includes scale factor of 3.7. See the ideogram below. [4641 ± 10 MeV OUR 2024 AVERAGE Scale factor = 2.7]
4603.1 ± 3.9 ± 0.8		¹ ABLIKIM	24BN BES3	$e^+e^- \rightarrow D_s^+ D_{s2}^{*-}(2573)^-$
4584 ± 14 ± 80		² ABLIKIM	24BN BES3	$e^+e^- \rightarrow D_s^+ D_{s1}^-(2536)^-$
4708 $^{+17}_{-15}$ ± 21		³ ABLIKIM	23BI BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$
4701.8 ± 10.9 ± 2.7		⁴ ABLIKIM	23H BES3	$e^+e^- \rightarrow \phi \chi_{c2}$
4675.3 ± 29.5 ± 3.5		⁵ ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$
4651.0 ± 37.8 ± 2.1		⁶ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$
4619.8 $^{+8.9}_{-8.0}$ ± 2.3	66	⁷ JIA	20 BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s2}^{*-}(2573)^-$
4625.9 $^{+6.2}_{-6.0}$ ± 0.4	89	⁸ JIA	19A BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s1}^-(2536)^-$
4652 ± 10 ± 11	279	⁹ WANG	15A BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
4669 ± 21 ± 3	37	¹⁰ LEES	14F BABR	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
4634 $^{+8}_{-7}$ $^{+5}_{-8}$	142	¹¹ PAKHLOVA	08B BELL	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4647.9 ± 8.6 ± 0.8		¹² ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
4652.5 ± 3.4 ± 1.1		¹³ DAI	17 RVUE	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
4645.2 ± 9.5 ± 6.0		¹⁴ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$
4646.4 ± 9.7 ± 4.8		¹⁵ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
4661 $^{+9}_{-8}$ ± 6	44	¹⁶ LIU	08H RVUE	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
4664 ± 11 ± 5	44	WANG	07D BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

NODE=M189M

NODE=M189M

NEW

OCCUR=2

NODE=M189M;LINKAGE=N

NODE=M189M;LINKAGE=O

NODE=M189M;LINKAGE=M

NODE=M189M;LINKAGE=J

NODE=M189M;LINKAGE=L

NODE=M189M;LINKAGE=G

NODE=M189M;LINKAGE=F

NODE=M189M;LINKAGE=E

NODE=M189M;LINKAGE=A

NODE=M189M;LINKAGE=LE

NODE=M189M;LINKAGE=PA

NODE=M189M;LINKAGE=I

NODE=M189M;LINKAGE=C

NODE=M189M;LINKAGE=D

¹ Extracted in a fit that employs two BW resonances. The second one at about 4720 MeV shows low statistical significance of 2.7 σ .

² Extracted from a fit with two BW functions. The second one located at about 4750 MeV show a low statistical significance of 4.3 σ .

³ Seen as a peak in the c.m. energy dependence of the $e^+e^- \rightarrow K^+ K^- J/\psi$ cross section using 5.85 fb⁻¹ of data at c.m. energies 4.61–4.95 GeV. Statistical significance is over 5 σ .

⁴ Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.

⁵ From a cross-section measurement of $e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4209.6 ± 7.5 (81.6 ± 19.9) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.

⁶ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

⁷ Using $D_{s2}^{*-}(2573)^- \rightarrow \bar{D}^0 K^-$ decays.

⁸ From a fit of a Breit-Wigner convolved with a Gaussian.

⁹ From a two-resonance fit. Supersedes WANG 07D.

¹⁰ From a two-resonance fit.

¹¹ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.

¹² From a fit to the $e^+e^- \rightarrow \pi^+ \pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass 4417.5 ± 26.2 ± 3.5 MeV and width 245 ± 48 ± 13 MeV.

¹³ The pole parameters are extracted from the speed plot.

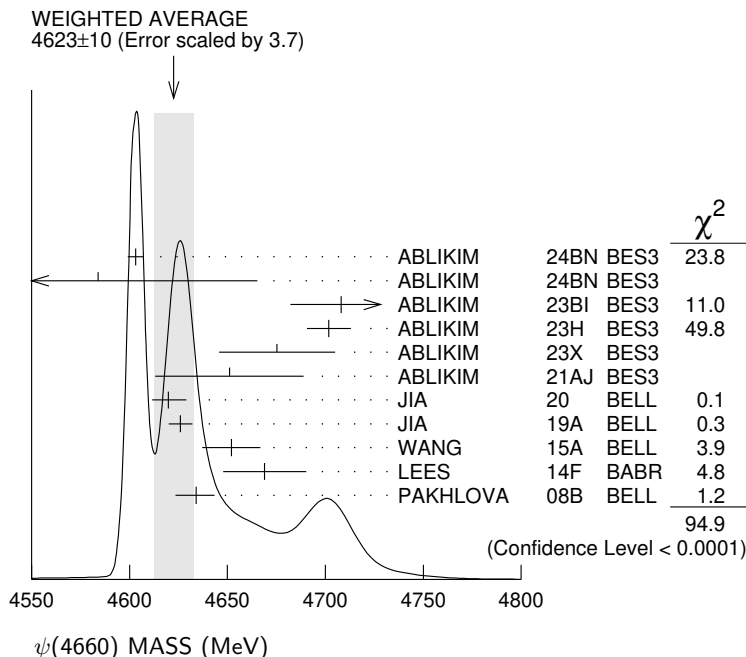
¹⁴ From a three-resonance fit.

15 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.

NODE=M189M;LINKAGE=B

16 From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189M;LINKAGE=LI



psi(4660) WIDTH

NODE=M189W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
55 ± 9	OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.		
[73 ⁺¹³ ₋₁₁ MeV	OUR 2024 AVERAGE	Scale factor = 1.7]		

NODE=M189W

NEW

57 ± 12 ± 219	1	ABLIKIM	24BN BES3	$e^+e^- \rightarrow D_s^+ D_{s1}^-(2536)^-$		
45.2 ± 5.7 ± 0.7	2	ABLIKIM	24BN BES3	$e^+e^- \rightarrow D_s^+ D_{s2}^*(2573)^-$		
126 ⁺²⁷ ₋₂₃ ± 30	3	ABLIKIM	23BI BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$		
30.5 ± 22.3 ± 14.6	4	ABLIKIM	23H BES3	$e^+e^- \rightarrow \phi \chi_{c2}$		
218.3 ± 72.9 ± 9.3	5	ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$		
155.4 ± 24.8 ± 0.8	6	ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$		
47.0 ^{+31.3} _{-14.8} ± 4.6	66	7	JIA	20 BELL		$e^+e^- \rightarrow \gamma D_s^+ D_{s2}^*(2573)^-$
49.8 ^{+13.9} _{-11.5} ± 4.0	89	8	JIA	19A BELL		$e^+e^- \rightarrow \gamma D_s^+ D_{s1}^-(2536)^-$
68 ± 11 ± 5	279	9	WANG	15A BELL		10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
104 ± 48 ± 10	37	10	LEES	14F BABR		10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
92 ⁺⁴⁰ ₋₂₄ ⁺¹⁰ ₋₂₁	142	11	PAKHLOVA	08B BELL		$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
33.1 ± 18.6 ± 4.1	12	ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$		
62.6 ± 5.6 ± 4.3	13	DAI	17 RVUE	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$		
113.8 ± 18.1 ± 3.4	14	ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$		
103.5 ± 15.6 ± 4.0	15	ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$		
42 ⁺¹⁷ ₋₁₂ ± 6	44	16	LIU	08H RVUE		10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
48 ± 15 ± 3	44	WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$		

OCCUR=2

1 Extracted from a fit with two BW functions. The second one located at about 4750 MeV show a low statistical significance of 4.3 σ .

NODE=M189W;LINKAGE=M

2 Extracted in a fit that employs two BW resonances. The second one at about 4720 MeV shows low statistical significance of 2.7 σ .

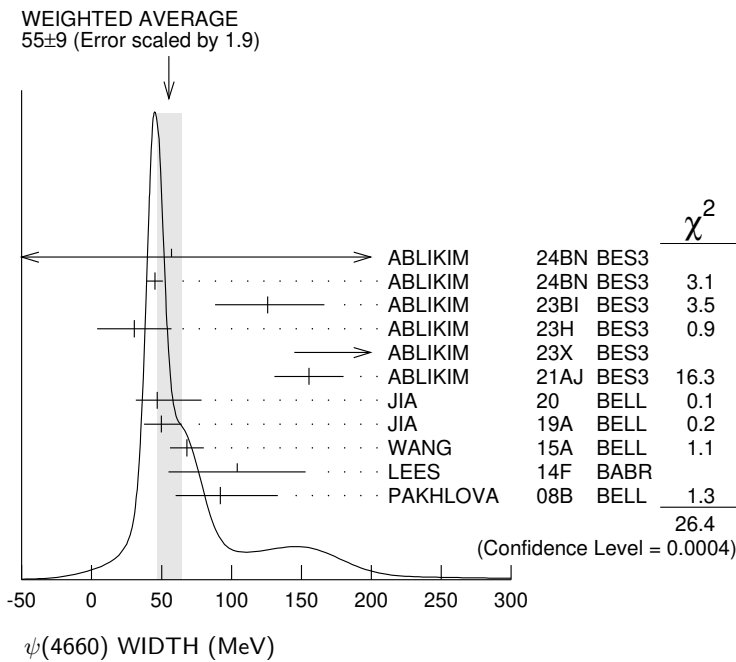
NODE=M189W;LINKAGE=N

3 Seen as a peak in the c.m. energy dependence of the $e^+e^- \rightarrow K^+ K^- J/\psi$ cross section using 5.85 fb⁻¹ of data at c.m. energies 4.61–4.95 GeV. Statistical significance is over 5 σ .

NODE=M189W;LINKAGE=L

- 4 Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.
- 5 From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4209.6 ± 7.5 (81.6 ± 19.9) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.
- 6 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.
- 7 Using $D_{s2}^*(2573)^- \rightarrow \bar{D}^0 K^-$ decays.
- 8 From a fit of a Breit-Wigner convolved with a Gaussian.
- 9 From a two-resonance fit. Supersedes WANG 07D.
- 10 From a two-resonance fit.
- 11 The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same.
- 12 From a fit to the $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.
- 13 The pole parameters are extracted from the speed plot.
- 14 From a three-resonance fit.
- 15 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^-J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- 16 From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189W;LINKAGE=J
 NODE=M189W;LINKAGE=E
 NODE=M189W;LINKAGE=H
 NODE=M189W;LINKAGE=G
 NODE=M189W;LINKAGE=F
 NODE=M189W;LINKAGE=A
 NODE=M189W;LINKAGE=LE
 NODE=M189W;LINKAGE=B
 NODE=M189W;LINKAGE=I
 NODE=M189W;LINKAGE=D
 NODE=M189W;LINKAGE=E
 NODE=M189W;LINKAGE=C
 NODE=M189W;LINKAGE=LI



ψ(4660) DECAY MODES

NODE=M189215;NODE=M189

Mode	Fraction (Γ_i/Γ)
Γ ₁ e^+e^-	not seen
Γ ₂ $\psi(2S)\pi^+\pi^-$	seen
Γ ₃ $J/\psi\eta$	not seen
Γ ₄ $D^0D^{*-}\pi^+$	not seen
Γ ₅ $D^{*0}D^{*-}\pi^+$	seen
Γ ₆ $\psi_2(3823)\pi^+\pi^-$	seen
Γ ₇ $\chi_{c1}\gamma$	not seen
Γ ₈ $\chi_{c1}\phi$	not seen
Γ ₉ $\chi_{c2}\gamma$	not seen
Γ ₁₀ $\chi_{c2}\phi$	not seen
Γ ₁₁ $\Lambda_c^+\Lambda_c^-$	seen
Γ ₁₂ $D_s^+D_{s1}(2536)^-$	seen
Γ ₁₃ $D_s^+D_{s2}^*(2573)^-$	seen
Γ ₁₄ $\omega\pi^0$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=15;OUR EVAL;→ UNCHECKED ←
 DESIG=10
 DESIG=6;OUR EVAL;→ UNCHECKED ←
 DESIG=13;OUR EVAL;→ UNCHECKED ←
 DESIG=7;OUR EVAL;→ UNCHECKED ←
 DESIG=14;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=9;OUR EVAL;→ UNCHECKED ←
 DESIG=11

Γ_{15}	$\omega\eta$	not seen	DESIG=12
Γ_{16}	$\Sigma^+ \bar{\Sigma}^-$	not seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_{17}	$\Xi^0 \bar{\Xi}^0$		DESIG=21
Γ_{18}	$\Xi^- \bar{\Xi}^+$	not seen	DESIG=16;OUR EVAL;→ UNCHECKED ←
Γ_{19}	$pK^- \bar{\Lambda}^+ + c.c.$	not seen	DESIG=17;OUR EVAL;→ UNCHECKED ←
Γ_{20}	$\Lambda \bar{\Xi}^+ K^- + c.c.$	not seen	DESIG=19;OUR EVAL;→ UNCHECKED ←
Γ_{21}	$\Sigma^0 \bar{\Xi}^+ K^- + c.c.$	not seen	DESIG=20;OUR EVAL;→ UNCHECKED ←

$\psi(4660) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M189230

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_2 \Gamma_1 / \Gamma$ NODE=M189G1
NODE=M189G1

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

4.7±3.8		¹ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$	
11.2±3.2		² ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$	OCCUR=2
4.7±4.2		³ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$	OCCUR=3
11.3±3.3		⁴ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$	OCCUR=4
2.0±0.3±0.2	279	⁵ WANG	15A BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	
8.1±1.1±1.0	279	⁶ WANG	15A BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	OCCUR=2
2.7±1.3±0.5	37	⁷ LEES	14F BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	
7.5±1.7±0.7	37	⁸ LEES	14F BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	OCCUR=2
2.2 ^{+0.7} _{-0.6}	44	⁹ LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	
5.9±1.6	44	¹⁰ LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	OCCUR=2
3.0±0.9±0.3	44	⁷ WANG	07D BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	
7.6±1.8±0.8	44	⁸ WANG	07D BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$	OCCUR=2

¹ Solution I of four equivalent solutions in a fit using three interfering resonances.² Solution II of four equivalent solutions in a fit using three interfering resonances.³ Solution III of four equivalent solutions in a fit using three interfering resonances.⁴ Solution IV of four equivalent solutions in a fit using three interfering resonances.⁵ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.⁶ Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.⁷ Solution I of two equivalent solutions in a fit using two interfering resonances.⁸ Solution II of two equivalent solutions in a fit using two interfering resonances.⁹ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.¹⁰ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189G1;LINKAGE=C

NODE=M189G1;LINKAGE=D

NODE=M189G1;LINKAGE=E

NODE=M189G1;LINKAGE=F

NODE=M189G1;LINKAGE=A

NODE=M189G1;LINKAGE=B

NODE=M189G1;LINKAGE=WA

NODE=M189G1;LINKAGE=WN

NODE=M189G1;LINKAGE=LI

NODE=M189G1;LINKAGE=LU

$\Gamma(J/\psi\eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_3 \Gamma_1 / \Gamma$ NODE=M189G01
NODE=M189G01

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

<0.94	90	WANG	13B BELL	$e^+ e^- \rightarrow J/\psi\eta\gamma$
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$\Gamma(D^{*0} D^{*-} \pi^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_5 \Gamma_1 / \Gamma$ NODE=M189R10
NODE=M189R10

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

19 to 2005	¹ ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$
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¹ From a cross-section measurement of $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. Depending on solutions I – VIII with same fit qualities.

NODE=M189R10;LINKAGE=A

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_7 \Gamma_1 / \Gamma$ NODE=M189G02
NODE=M189G02

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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<0.45	90	¹ HAN	15 BELL	10.58 $e^+ e^- \rightarrow \chi_{c1}\gamma$
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¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M189G02;LINKAGE=A

$\Gamma(\chi_{c1}\phi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$

 $\Gamma_8 \Gamma_1 / \Gamma$ NODE=M189R08
NODE=M189R08

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

<0.04	90	¹ ABLIKIM	23H BES3	$e^+ e^- \rightarrow \phi\chi_{c1}$
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¹ Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.

NODE=M189R08;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ HAN	15	BELL 10.58 e ⁺ e ⁻ → χ _{c2} γ

¹ Using B(η → γγ) = (39.41 ± 0.21)%.

NODE=M189G03
NODE=M189G03

NODE=M189G03;LINKAGE=A

$$\Gamma(\chi_{c2}\phi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{10}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
0.13 ± 0.13	¹ ABLIKIM	23H	BES3 e ⁺ e ⁻ → φχ _{c2}

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13 ± 0.13 ¹ ABLIKIM 23H BES3 e⁺e⁻ → φχ_{c2}

¹ Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term. Constructive solution of the interference. Destructive solution gives 0.66 ± 0.41 eV.

NODE=M189R09
NODE=M189R09

NODE=M189R09;LINKAGE=A

$$\Gamma(D_s^+ D_{s1}(2536)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_1/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
14.3 ^{+2.8} _{-2.6} ± 1.5	89	¹ JIA	19A	BELL e ⁺ e ⁻ → γD _s ⁺ D _{s1} (2536) ⁻

¹ Assuming B(D_{s1}(2536)⁻ → D⁰K⁻) = 1.

NODE=M189R00
NODE=M189R00

NODE=M189R00;LINKAGE=A

$$\Gamma(D_s^+ D_{s2}^*(2573)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}\Gamma_1/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
14.7 ^{+5.9} _{-4.5} ± 3.6	66	¹ JIA	20	BELL e ⁺ e ⁻ → γD _s ⁺ D _{s2} [*] (2573) ⁻

¹ Assuming B(D_{s2}^{*}(2573)⁻ → D⁰K⁻) = 1.

NODE=M189R04
NODE=M189R04

NODE=M189R04;LINKAGE=A

$$\Gamma(\Sigma^+ \bar{\Sigma}^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{16}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<49.6 × 10 ⁻³	90	¹ ABLIKIM	24AH	BES3 e ⁺ e ⁻ → Σ ⁺ Σ ⁻

¹ Interference effect between resonance and continuum amplitudes is considered. Two solutions from the fit.

NODE=M189R14
NODE=M189R14

NODE=M189R14;LINKAGE=A

$$\Gamma(\Xi^0 \bar{\Xi}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<45.0 × 10 ⁻³	90	¹ ABLIKIM	24CD	BES3 e ⁺ e ⁻ → ψ(4660)

¹ From a fit to e⁺e⁻ → Ξ⁰Ξ⁰ cross sections.

NODE=M189R17
NODE=M189R17

NODE=M189R17;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<19.9 × 10 ⁻³ (CL = 90%)				[<0.0199 eV (CL = 90%) OUR 2024 BEST LIMIT]
<19.9 × 10 ⁻³	90	¹ ABLIKIM	23BK	BES3 e ⁺ e ⁻ → ψ(4660)

¹ From a fit to e⁺e⁻ → Ξ⁻Ξ⁺ cross sections.

NODE=M189R11
NODE=M189R11

NODE=M189R11;LINKAGE=A

$$\Gamma(pK^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.8 × 10 ⁻³	90	¹ ABLIKIM	23BL	BES3 e ⁺ e ⁻ → ψ(4660)

¹ From a fit to e⁺e⁻ → pK⁻Λ̄ + c.c. cross sections.

NODE=M189R13
NODE=M189R13

NODE=M189R13;LINKAGE=A

$$\Gamma(\Lambda \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<13.0 × 10 ⁻³	90	¹ ABLIKIM	24AL	BES3 e ⁺ e ⁻ → ΛΞ ⁺ K ⁻ + c.c.

¹ A fit to the Born cross section of e⁺e⁻ → ΛΞ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M189R15
NODE=M189R15

NODE=M189R15;LINKAGE=A

$$\Gamma(\Sigma^0 \bar{\Xi}^+ K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<77.3 × 10 ⁻³	90	¹ ABLIKIM	24AL	BES3 e ⁺ e ⁻ → Σ ⁰ Ξ ⁺ K ⁻ + c.c.

¹ A fit to the Born cross section of e⁺e⁻ → Σ⁰Ξ⁺K⁻ + c.c. including interference with the continuum. Two solutions from the fit.

NODE=M189R16
NODE=M189R16

NODE=M189R16;LINKAGE=A

$$\psi(4660) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M189235

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.37 × 10 ⁻⁶	90	¹ PAKHLOVA	09	BELL e ⁺ e ⁻ → D ⁰ D ^{*-} π ⁺

¹ Using 4664 ± 11 ± 5 MeV for the mass of ψ(4660).

NODE=M189R02
NODE=M189R02

NODE=M189R02;LINKAGE=PA

$\Gamma(\Lambda_c^+ \Lambda_c^-)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$					$\Gamma_{11}/\Gamma \times \Gamma_1/\Gamma$
VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.68^{+0.16+0.29}_{-0.15-0.30}$	142	¹ PAKHLOVA	08B	BELL	$e^+ e^- \rightarrow \Lambda_c^+ \Lambda_c^-$

NODE=M189R03
NODE=M189R03

¹ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.

NODE=M189R03;LINKAGE=A

$\psi(4660)$ BRANCHING RATIOS

NODE=M189225

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S)\pi^+ \pi^-)$					Γ_4/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<10	90	PAKHLOVA	09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M189R01
NODE=M189R01

$\Gamma(\psi_2(3823)\pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		¹ ABLIKIM	22R	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

NODE=M189R05
NODE=M189R05

¹ From a fit to the $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances.

NODE=M189R05;LINKAGE=A

$\Gamma(\omega \pi^0)/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
not seen		ABLIKIM	22K	BES3	$e^+ e^- \rightarrow \omega \pi^0$

NODE=M189R06
NODE=M189R06

$\Gamma(\omega \eta)/\Gamma_{\text{total}}$					Γ_{15}/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
not seen		ABLIKIM	22K	BES3	$e^+ e^- \rightarrow \omega \eta$

NODE=M189R07
NODE=M189R07

$\psi(4660)$ REFERENCES

NODE=M189

ABLIKIM	24AH	JHEP 2405 022	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62688
ABLIKIM	24AL	JHEP 2407 258	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62693
ABLIKIM	24BN	PRL 133 171903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63015
ABLIKIM	24CD	JHEP 2411 062	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=63037
ABLIKIM	23BI	PRL 131 211902	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62434
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	23H	JHEP 2301 132	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62050
ABLIKIM	23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62072
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61664
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61441
JIA	20	PR D101 091101	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=60301
JIA	19A	PR D100 111103	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=60037
DAI	17	PR D96 116001	L.-Y. Dai, J. Haidenbauer, U.-G. Meissner	(JULI+)	REFID=58704
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang		REFID=58219
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan		REFID=58463
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=56839
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55938
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
PAKHLOVA	08B	PRL 101 172001	C. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52596
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959

$\chi_{c1}(4685)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M261

OMITTED FROM SUMMARY TABLE

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M261

Seen by AAIJ 21E in $B^+ \rightarrow \chi_{c1}(4685)K^+$ with $\chi_{c1}(4685) \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 15σ . The $J^P = 1^+$ assignment is favored with high significance.

 $\chi_{c1}(4685)$ MASS

NODE=M261M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4684 \pm 7^{+13}_{-16}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M261M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 15σ .

NODE=M261M;LINKAGE=A

 $\chi_{c1}(4685)$ WIDTH

NODE=M261W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$126 \pm 15^{+37}_{-41}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M261W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 15σ .

NODE=M261W;LINKAGE=A

 $\chi_{c1}(4685)$ DECAY MODES

NODE=M261215;NODE=M261

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen

DESIG=1

 $\chi_{c1}(4685)$ BRANCHING RATIOS

NODE=M261225

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$	

NODE=M261R01
NODE=M261R01

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 15σ .

NODE=M261R01;LINKAGE=A

 $\chi_{c1}(4685)$ REFERENCES

NODE=M261

AAIJ	21E	PRL 127 082001	R. Aaij et al.	(LHCb Collab.) JP
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REFID=61150

$\chi_{c0}(4700)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE
was $X(4700)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c0} K^+$, $\chi_{c0} \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 5.6σ .

NODE=M235

NODE=M235

 $\chi_{c0}(4700)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4694 \pm 4^{+16}_{-3}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$
••• We do not use the following data for averages, fits, limits, etc. •••				
$4741 \pm 6 \pm 6$	175	² AAIJ	21C LHCB	$B_s^0 \rightarrow J/\psi\phi\pi^+\pi^-$
$4704 \pm 10^{+14}_{-24}$	4289	^{3,4} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M235M

NODE=M235M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 17σ .

² From a 1D fit to the $J/\psi\phi$ mass distribution with a significance of 5.3σ . The identification of this structure as the $\chi_{c0}(4700)$ needs confirmation.

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.6σ .

⁴ Superseded by AAIJ 21E.

NODE=M235M;LINKAGE=C

NODE=M235M;LINKAGE=B

NODE=M235M;LINKAGE=A

NODE=M235M;LINKAGE=D

 $\chi_{c0}(4700)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$87 \pm 8^{+16}_{-6}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$
••• We do not use the following data for averages, fits, limits, etc. •••				
$53 \pm 15 \pm 11$	175	² AAIJ	21C LHCB	$B_s^0 \rightarrow J/\psi\phi\pi^+\pi^-$
$120 \pm 31^{+42}_{-33}$	4289	^{3,4} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M235W

NODE=M235W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 17σ .

² From a 1D fit to the $J/\psi\phi$ mass distribution with a significance of 5.3σ . The identification of this structure as the $\chi_{c0}(4700)$ needs confirmation.

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.6σ .

⁴ Superseded by AAIJ 21E.

NODE=M235W;LINKAGE=C

NODE=M235W;LINKAGE=B

NODE=M235W;LINKAGE=A

NODE=M235W;LINKAGE=D

 $\chi_{c0}(4700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen

NODE=M235215;NODE=M235

DESIG=1

 $\chi_{c0}(4700)$ BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi\phi K^+$
••• We do not use the following data for averages, fits, limits, etc. •••				
seen	175	² AAIJ	21C LHCB	$B_s^0 \rightarrow J/\psi\phi\pi^+\pi^-$
seen	4289	^{3,4} AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M235220

NODE=M235R01

NODE=M235R01

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 17σ .

² From a 1D fit to the $J/\psi\phi$ mass distribution with a significance of 5.3σ . The identification of this structure as the $\chi_{c0}(4700)$ needs confirmation.

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 5.6σ .

⁴ Superseded by AAIJ 21E.

NODE=M235R01;LINKAGE=C

NODE=M235R01;LINKAGE=B

NODE=M235R01;LINKAGE=A

NODE=M235R01;LINKAGE=D

 $\chi_{c0}(4700)$ REFERENCES

AAIJ	21C	JHEP 2102 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M235

REFID=61124

REFID=61150

REFID=57657

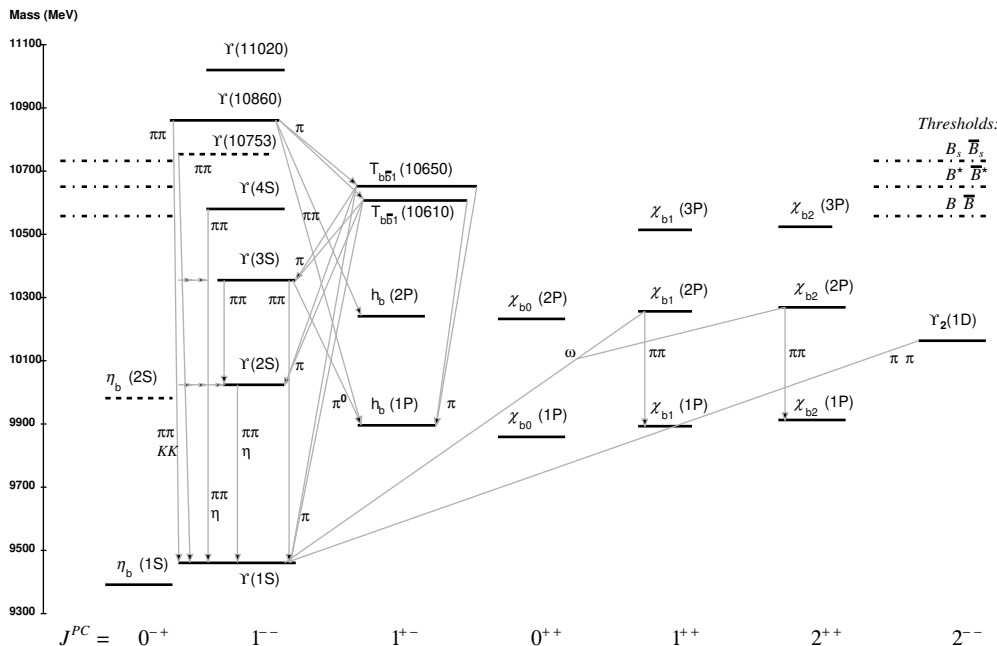
REFID=57636

$b\bar{b}$ MESONS (including possibly non- $q\bar{q}$ states)

NODE=MXXX030

NODE=M849

Updated March 2024.



The level scheme of meson states containing a minimal quark content of $b\bar{b}$ and having $S = C = B = 0$. The name of a state is determined by its quantum numbers $I^G J^{PC}$ (see the review “Naming Scheme for Hadrons”). States included in the Summary Tables are shown with solid lines; those requiring confirmation are shown with dotted lines. The arrows indicate the most dominant hadronic transitions. Single photon transitions, including $\Upsilon(nS) \rightarrow \gamma\eta_b(mS)$, $\Upsilon(nS) \rightarrow \gamma\chi_{bJ}(mP)$, and $\chi_{bJ}(nP) \rightarrow \gamma\Upsilon(mS)$, are omitted for clarity. For orientation, the location of the thresholds related to a pair of ground state open bottom mesons is indicated in the figure. Decays to open flavour final states are not shown in the figure. The transitions $\Upsilon(10753) \rightarrow \omega\chi_{b1}(1P), \omega\chi_{b2}(1P)$ have also been reported.

NODE=M849

WIDTH DETERMINATIONS OF THE Υ STATES

As is the case for the $J/\psi(1S)$ and $\psi(2S)$, the full widths of the $b\bar{b}$ states $\Upsilon(1S)$, $\Upsilon(2S)$, and $\Upsilon(3S)$ are not directly measurable, since they are much narrower than the energy resolution of the e^+e^- storage rings where these states are

produced. The common indirect method to determine Γ starts from

$$\Gamma = \Gamma_{\ell\ell}/B_{\ell\ell} , \quad (2.1)$$

where $\Gamma_{\ell\ell}$ is one leptonic partial width and $B_{\ell\ell}$ is the corresponding branching fraction ($\ell = e, \mu, \text{ or } \tau$). One then assumes e - μ - τ universality and uses

$$\begin{aligned} \Gamma_{\ell\ell} &= \Gamma_{ee} \\ B_{\ell\ell} &= \text{average of } B_{ee}, B_{\mu\mu}, \text{ and } B_{\tau\tau} . \end{aligned} \quad (2.2)$$

The electronic partial width Γ_{ee} is also not directly measurable at e^+e^- storage rings, only in the combination $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$, where Γ_{had} is the hadronic partial width and

$$\Gamma_{\text{had}} + 3\Gamma_{ee} = \Gamma . \quad (2.3)$$

This combination is obtained experimentally from the energy-integrated hadronic cross section

$$\begin{aligned} &\int_{\text{resonance}} \sigma(e^+e^- \rightarrow \Upsilon \rightarrow \text{hadrons})dE \\ &= \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma} C_r = \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}^{(0)}\Gamma_{\text{had}}}{\Gamma} C_r^{(0)} , \end{aligned} \quad (2.4)$$

where M is the Υ mass, and C_r and $C_r^{(0)}$ are radiative correction factors. C_r is used for obtaining Γ_{ee} as defined in Eq. (2.1), and contains corrections from all orders of QED for describing $(b\bar{b}) \rightarrow e^+e^-$. The lowest order QED value $\Gamma_{ee}^{(0)}$, relevant for comparison with potential-model calculations, is defined by the lowest order QED graph (Born term) alone, and is about 7% lower than Γ_{ee} .

The Listings give experimental results on B_{ee} , $B_{\mu\mu}$, $B_{\tau\tau}$, and $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$. The entries of the last quantity have been re-evaluated consistently using the correction procedure of KURA EV 85 [1]. The partial width Γ_{ee} is obtained from the average values for $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$ and $B_{\ell\ell}$ using

$$\Gamma_{ee} = \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma(1 - 3B_{\ell\ell})} . \quad (2.5)$$

The total width Γ is then obtained from Eq. (2.1). We do not list Γ_{ee} and Γ values of individual experiments. The Γ_{ee} values in the Meson Summary Table are also those defined in Eq. (2.1).

References

1. E.A. Kuraev, V.S. Fadin, Sov. J. Nucl. Phys. **41**, 466 (1985).
-

$\eta_b(1S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Quantum numbers shown are quark-model predictions. Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$.

NODE=M171

NODE=M171

NODE=M171M

NODE=M171M

$\eta_b(1S)$ MASS

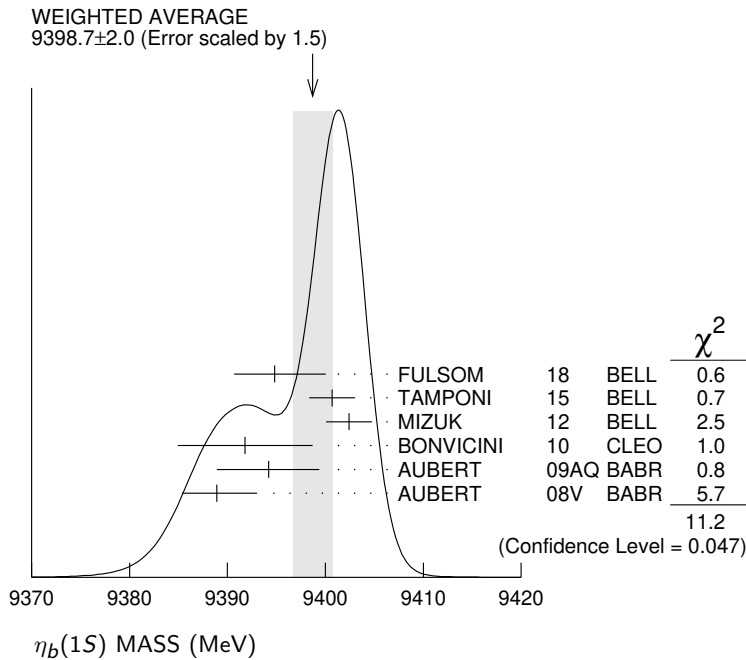
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9398.7 ± 2.0 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
9394.8 ^{+2.7} _{-3.1} ± 4.5 _{-2.7}	29k	FULSOM	18 BELL	$\Upsilon(2S) \rightarrow \gamma X$
9400.7 ± 1.7 ± 1.6	33.1k	TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
9402.4 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$
9391.8 ± 6.6 ± 2.0	2.3k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
9394.2 ^{+4.8} _{-4.9} ± 2.0	13k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
9388.9 ^{+3.1} _{-2.3} ± 2.7	19k	² AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
9393.2 ± 3.4 ± 2.3	10	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{hadrons}$
9300 ± 20 ± 20		HEISTER	02D ALEP	181-209 e^+e^-

- ¹ With floating width. Not independent of the corresponding mass difference measurement.
- ² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.
- ³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M;LINKAGE=MI

NODE=M171M;LINKAGE=AU

NODE=M171M;LINKAGE=DO



$m_{\Upsilon(1S)} - m_{\eta_b}$

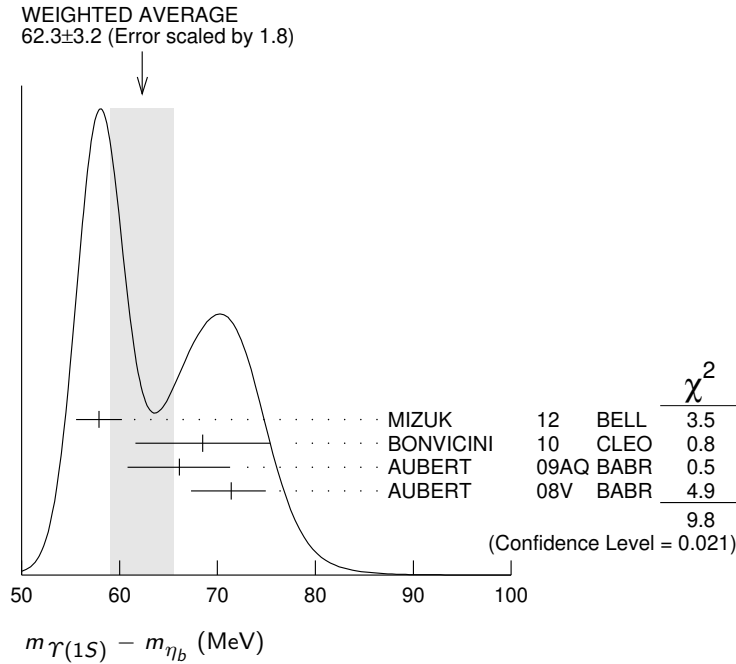
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
62.3 ± 3.2 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
57.9 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$
68.5 ± 6.6 ± 2.0	2.3 ± 0.5k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
66.1 ^{+4.8} _{-4.9} ± 2.0	13 ± 5k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
71.4 ^{+2.3} _{-3.1} ± 2.7	19 ± 3k	² AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
67.1 ± 3.4 ± 2.3	10 ⁺⁵ ₋₄	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{hadrons}$

NODE=M171M2

NODE=M171M2

- ¹With floating width. Not independent of the corresponding mass measurement.
- ²Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.
- ³Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M2;LINKAGE=MI
 NODE=M171M2;LINKAGE=AU
 NODE=M171M2;LINKAGE=DO



γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M171DM
 NODE=M171DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
920.6^{+2.8}_{-3.2} OUR AVERAGE				
918.6 ± 6.0 ± 1.9	2.3 ± 0.5k	¹ BONVICINI	10	CLEO $\Upsilon(3S) \rightarrow \gamma X$
921.2 ^{+2.1} _{-2.8} ± 2.4	19 ± 3k	¹ AUBERT	08V	BABR $\Upsilon(3S) \rightarrow \gamma X$

¹Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171DM;LINKAGE=BO

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M171U2S
 NODE=M171U2S

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
609.3^{+4.6}_{-4.5} ± 1.9				
	13 ± 5k	¹ AUBERT	09AQ	BABR $\Upsilon(2S) \rightarrow \gamma X$

¹Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171U2S;LINKAGE=AU

$\eta_b(1S)$ WIDTH

NODE=M171W
 NODE=M171W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10⁺⁵₋₄ OUR AVERAGE				
8 ⁺⁶ ₋₅ ± 5	33.1k	¹ TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
10.8 ^{+4.0+4.5} _{-3.7-2.0}	34k	¹ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

¹With floating mass.

NODE=M171W;LINKAGE=MI

$\eta_b(1S)$ DECAY MODES

NODE=M171225;NODE=M171

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	seen	
Γ_2 $3h^+3h^-$	not seen	
Γ_3 $2h^+2h^-$	not seen	
Γ_4 $4h^+4h^-$	not seen	
Γ_5 $\gamma\gamma$	not seen	
Γ_6 $\mu^+\mu^-$	$<9 \times 10^{-3}$	90%
Γ_7 $\tau^+\tau^-$	$<8\%$	90%

DESIG=7
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=5
DESIG=6

 $\eta_b(1S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M171230

$\Gamma(3h^+3h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_5/\Gamma$

NODE=M171G1
NODE=M171G1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<470	95	ABDALLAH	06	DLPH	161-209 e^+e^-
<132	95	HEISTER	02D	ALEP	181-209 e^+e^-

$\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_5/\Gamma$

NODE=M171G2
NODE=M171G2

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<190	95	ABDALLAH	06	DLPH	161-209 e^+e^-
< 48	95	HEISTER	02D	ALEP	181-209 e^+e^-

$\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_5/\Gamma$

NODE=M171G3
NODE=M171G3

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<660	95	ABDALLAH	06	DLPH	161-209 e^+e^-
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 $\eta_b(1S)$ BRANCHING RATIOS

NODE=M171235

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

NODE=M171R03
NODE=M171R03

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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seen	34k	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$
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$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_6/Γ

NODE=M171R01
NODE=M171R01

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$<9 \times 10^{-3}$	90	¹ AUBERT	09Z	BABR $e^+e^- \rightarrow \Upsilon(2S, 3S) \rightarrow \gamma\eta_b$
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¹ Obtained using $B(\Upsilon(2S) \rightarrow \gamma\eta_b) = (4.2^{+1.1}_{-1.0} \pm 0.9) \times 10^{-4}$ and $B(\Upsilon(3S) \rightarrow \gamma\eta_b) = (4.8 \pm 0.5 \pm 0.6) \times 10^{-4}$. This limit is equivalent to $B(\eta_b \rightarrow \mu^+\mu^-) = (-0.25 \pm 0.51 \pm 0.33)\%$ measurement.

NODE=M171R01;LINKAGE=AU

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=M171R02
NODE=M171R02

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$<8 \times 10^{-2}$	90	AUBERT	09P	BABR $e^+e^- \rightarrow \gamma\tau^+\tau^-$
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 $\eta_b(1S)$ REFERENCES

NODE=M171

FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)	REFID=59535
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=56996
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>		REFID=54288
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=54718
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53062
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52262
ABDALLAH	06	PL B634 340	J.M. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=51042
HEISTER	02D	PL B530 56	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48577

$\Upsilon(1S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M049

 $\Upsilon(1S)$ MASS

NODE=M049M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9460.40±0.10 OUR AVERAGE				
9460.37±0.01±2.85	15M	¹ AAIJ	24AC LHCB	$\Upsilon(1S) \rightarrow \mu^+ \mu^-$
9460.40±0.09±0.04		² SHAMOV	23 RVUE	$e^+ e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
9460.11±0.11±0.07		³ SHAMOV	23 RVUE	$e^+ e^- \rightarrow$ hadrons
9460.51±0.09±0.05		^{4,5} ARTAMONOV	00 MD1	$e^+ e^- \rightarrow$ hadrons
9460.60±0.09±0.05		^{6,7} BARU	92B MD1	$e^+ e^- \rightarrow$ hadrons
9460.59±0.12		BARU	86 MD1	$e^+ e^- \rightarrow$ hadrons
9460.6 ±0.4		^{7,8} ARTAMONOV	84 MD1	$e^+ e^- \rightarrow$ hadrons
9459.97±0.11±0.07		⁹ MACKAY	84 CUSB	$e^+ e^- \rightarrow$ hadrons

NODE=M049M

OCCUR=2

¹ Observed in prompt pp production.² Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.³ Obtained by reanalysing CUSB data (MACKAY 84), but not authored by the CUSB collaboration.⁴ Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).⁵ Superseded by SHAMOV 23.⁶ Supersedes BARU 86.⁷ Superseded by ARTAMONOV 00.⁸ Value includes data of ARTAMONOV 82.⁹ Reanalysed by SHAMOV 23.NODE=M049M;LINKAGE=F
NODE=M049M;LINKAGE=D

NODE=M049M;LINKAGE=E

NODE=M049M;LINKAGE=AR
NODE=M049M;LINKAGE=B
NODE=M049M;LINKAGE=A
NODE=M049M;LINKAGE=RZ
NODE=M049M;LINKAGE=G
NODE=M049M;LINKAGE=C **$\Upsilon(1S)$ WIDTH**

NODE=M049W

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M049W
→ UNCHECKED ← **$\Upsilon(1S)$ DECAY MODES**

NODE=M049215;NODE=M049

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\tau^+ \tau^-$	(2.60 ±0.10) %	
Γ_2 $e^+ e^-$	(2.39 ±0.08) %	
Γ_3 $\mu^+ \mu^-$	(2.48 ±0.04) %	

DESIG=3

DESIG=2

DESIG=1

Hadronic decays

NODE=M049;CLUMP=A

Γ_4 ggg	(81.7 ±0.7) %	
Γ_5 $\gamma g g$	(2.2 ±0.6) %	
Γ_6 $\eta'(958)$ anything	(2.94 ±0.24) %	
Γ_7 $J/\psi(1S)$ anything	(5.4 ±0.4) × 10 ⁻⁴	S=1.4
Γ_8 $J/\psi(1S)\eta_c$	< 2.2	× 10 ⁻⁶ CL=90%
Γ_9 $J/\psi(1S)\chi_{c0}$	< 3.4	× 10 ⁻⁶ CL=90%
Γ_{10} $J/\psi(1S)\chi_{c1}$	(3.9 ±1.2) × 10 ⁻⁶	
Γ_{11} $J/\psi(1S)\chi_{c2}$	< 1.4	× 10 ⁻⁶ CL=90%
Γ_{12} $J/\psi(1S)\eta_c(2S)$	< 2.2	× 10 ⁻⁶ CL=90%
Γ_{13} $J/\psi(1S)X(3940)$	< 5.4	× 10 ⁻⁶ CL=90%
Γ_{14} $J/\psi(1S)X(4160)$	< 5.4	× 10 ⁻⁶ CL=90%
Γ_{15} $X(4350)$ anything, $X \rightarrow J/\psi(1S)\phi$	< 8.1	× 10 ⁻⁶ CL=90%
Γ_{16} $T_{c\bar{c}1}(3900)^\pm$ anything, $T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm$	< 1.3	× 10 ⁻⁵ CL=90%
Γ_{17} $T_{c\bar{c}1}(4200)^\pm$ anything, $Z_c \rightarrow J/\psi(1S)\pi^\pm$	< 6.0	× 10 ⁻⁵ CL=90%
Γ_{18} $T_{c\bar{c}1}(4430)^\pm$ anything, $T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm$	< 4.9	× 10 ⁻⁵ CL=90%
Γ_{19} X_{cs}^\pm anything, $X \rightarrow J/\psi K^\pm$	< 5.7	× 10 ⁻⁶ CL=90%

DESIG=117

DESIG=118

DESIG=73

DESIG=12

DESIG=146

DESIG=147

DESIG=148

DESIG=149

DESIG=150

DESIG=151

DESIG=152

DESIG=167

DESIG=168

DESIG=169

DESIG=170

DESIG=173

Γ ₂₀	$\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)\pi^+\pi^-$	< 3.8	$\times 10^{-5}$	CL=90%	DESIG=161
Γ ₂₁	$\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)K^+K^-$	< 7.5	$\times 10^{-6}$	CL=90%	DESIG=165
Γ ₂₂	$\chi_{c1}(4140)$ anything, $\chi_{c1} \rightarrow J/\psi(1S)\phi$	< 5.2	$\times 10^{-6}$	CL=90%	DESIG=166
Γ ₂₃	χ_{c0} anything	< 4	$\times 10^{-3}$	CL=90%	DESIG=5
Γ ₂₄	χ_{c1} anything	(1.90 ± 0.35)	$\times 10^{-4}$		DESIG=6
Γ ₂₅	$\chi_{c1}(1P)X_{tetra}$	< 3.78	$\times 10^{-5}$	CL=90%	DESIG=175
Γ ₂₆	χ_{c2} anything	(2.8 ± 0.8)	$\times 10^{-4}$		DESIG=7
Γ ₂₇	$\psi(2S)$ anything	(1.23 ± 0.20)	$\times 10^{-4}$		DESIG=8
Γ ₂₈	$\psi(2S)\eta_c$	< 3.6	$\times 10^{-6}$	CL=90%	DESIG=153
Γ ₂₉	$\psi(2S)\chi_{c0}$	< 6.5	$\times 10^{-6}$	CL=90%	DESIG=154
Γ ₃₀	$\psi(2S)\chi_{c1}$	< 4.5	$\times 10^{-6}$	CL=90%	DESIG=155
Γ ₃₁	$\psi(2S)\chi_{c2}$	< 2.1	$\times 10^{-6}$	CL=90%	DESIG=156
Γ ₃₂	$\psi(2S)\eta_c(2S)$	< 3.2	$\times 10^{-6}$	CL=90%	DESIG=157
Γ ₃₃	$\psi(2S)X(3940)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=158
Γ ₃₄	$\psi(2S)X(4160)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=159
Γ ₃₅	$\psi(4230)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 7.9	$\times 10^{-5}$	CL=90%	DESIG=162
Γ ₃₆	$\psi(4360)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 5.2	$\times 10^{-5}$	CL=90%	DESIG=163
Γ ₃₇	$\psi(4660)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 2.2	$\times 10^{-5}$	CL=90%	DESIG=164
Γ ₃₈	$T_{c\bar{c}}(4050)^\pm$ anything, $X \rightarrow \psi(2S)\pi^\pm$	< 8.8	$\times 10^{-5}$	CL=90%	DESIG=171
Γ ₃₉	$T_{c\bar{c}1}(4430)^\pm$ anything, $T_{c\bar{c}1} \rightarrow \psi(2S)\pi^\pm$	< 6.7	$\times 10^{-5}$	CL=90%	DESIG=172
Γ ₄₀	$\chi_{c1}(3872)$ anything	< 2.2	$\times 10^{-4}$	CL=90%	DESIG=194
Γ ₄₁	$T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-$	< 2.23	$\times 10^{-5}$	CL=90%	DESIG=178
Γ ₄₂	$T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp$	< 8.1	$\times 10^{-6}$	CL=90%	DESIG=179
Γ ₄₃	$T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-$	< 1.8	$\times 10^{-6}$	CL=90%	DESIG=180
Γ ₄₄	$T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-$	< 1.58	$\times 10^{-5}$	CL=90%	DESIG=181
Γ ₄₅	$T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-$	< 2.66	$\times 10^{-5}$	CL=90%	DESIG=182
Γ ₄₆	$T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp$	< 4.42	$\times 10^{-5}$	CL=90%	DESIG=183
Γ ₄₇	$T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-$	< 2.03	$\times 10^{-5}$	CL=90%	DESIG=184
Γ ₄₈	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp$	< 2.33	$\times 10^{-5}$	CL=90%	DESIG=186
Γ ₄₉	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp$	< 4.55	$\times 10^{-5}$	CL=90%	DESIG=189
Γ ₅₀	$\rho\pi$	< 3.68	$\times 10^{-6}$	CL=90%	DESIG=11
Γ ₅₁	$\omega\pi^0$	< 3.90	$\times 10^{-6}$	CL=90%	DESIG=131
Γ ₅₂	$\pi^+\pi^-$	< 5	$\times 10^{-4}$	CL=90%	DESIG=23
Γ ₅₃	K^+K^-	< 5	$\times 10^{-4}$	CL=90%	DESIG=24
Γ ₅₄	$\rho\bar{\rho}$	< 5	$\times 10^{-4}$	CL=90%	DESIG=25
Γ ₅₅	$\pi^+\pi^-\pi^0$	(2.1 ± 0.8)	$\times 10^{-6}$		DESIG=72
Γ ₅₆	ϕK^+K^-	(2.4 ± 0.5)	$\times 10^{-6}$		DESIG=136
Γ ₅₇	$\omega\pi^+\pi^-$	(4.5 ± 1.0)	$\times 10^{-6}$		DESIG=137
Γ ₅₈	$K^*(892)^0 K^-\pi^+ + \text{c.c.}$	(4.4 ± 0.8)	$\times 10^{-6}$		DESIG=138
Γ ₅₉	$\phi f'_2(1525)$	< 1.63	$\times 10^{-6}$	CL=90%	DESIG=139
Γ ₆₀	$\omega f_2(1270)$	< 1.79	$\times 10^{-6}$	CL=90%	DESIG=140
Γ ₆₁	$\rho(770) a_2(1320)$	< 2.24	$\times 10^{-6}$	CL=90%	DESIG=141
Γ ₆₂	$K^*(892)^0 K_2^*(1430)^0 + \text{c.c.}$	(3.0 ± 0.8)	$\times 10^{-6}$		DESIG=142
Γ ₆₃	$K_1(1270)^\pm K^\mp$	< 2.41	$\times 10^{-6}$	CL=90%	DESIG=143
Γ ₆₄	$K_1(1400)^\pm K^\mp$	(1.0 ± 0.4)	$\times 10^{-6}$		DESIG=144
Γ ₆₅	$b_1(1235)^\pm \pi^\mp$	< 1.25	$\times 10^{-6}$	CL=90%	DESIG=145
Γ ₆₆	$\pi^+\pi^-\pi^0\pi^0$	(1.28 ± 0.30)	$\times 10^{-5}$		DESIG=132
Γ ₆₇	$K_S^0 K^+\pi^- + \text{c.c.}$	(1.6 ± 0.4)	$\times 10^{-6}$		DESIG=133
Γ ₆₈	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(2.9 ± 0.9)	$\times 10^{-6}$		DESIG=134
Γ ₆₉	$K^*(892)^- K^+ + \text{c.c.}$	< 1.11	$\times 10^{-6}$	CL=90%	DESIG=135
Γ ₇₀	$f_1(1285)$ anything	(4.6 ± 3.1)	$\times 10^{-3}$		DESIG=174
Γ ₇₁	$D^*(2010)^\pm$ anything	(2.52 ± 0.20)	%		DESIG=30
Γ ₇₂	$f_1(1285)X_{tetra}$	< 6.24	$\times 10^{-5}$	CL=90%	DESIG=176
Γ ₇₃	2H anything	(2.85 ± 0.25)	$\times 10^{-5}$		DESIG=107
Γ ₇₄	Sum of 100 exclusive modes	(1.200 ± 0.017)	%		DESIG=128

Radiative decays

				NODE=M049;CLUMP=B
Γ ₇₅	$\gamma\pi^+\pi^-$	(6.3 ±1.8)	$\times 10^{-5}$	DESIG=70
Γ ₇₆	$\gamma\pi^0\pi^0$	(1.7 ±0.7)	$\times 10^{-5}$	DESIG=71
Γ ₇₇	$\gamma\pi\pi$ (S-wave)	(4.6 ±0.7)	$\times 10^{-5}$	DESIG=190
Γ ₇₈	$\gamma\pi^0\eta$	< 2.4	$\times 10^{-6}$	CL=90% DESIG=111
Γ ₇₉	$\gamma K^+ K^-$	[a] (1.14 ±0.13)	$\times 10^{-5}$	DESIG=102
Γ ₈₀	$\gamma p\bar{p}$	[b] < 6	$\times 10^{-6}$	CL=90% DESIG=103
Γ ₈₁	$\gamma 2h^+ 2h^-$	(7.0 ±1.5)	$\times 10^{-4}$	DESIG=20
Γ ₈₂	$\gamma 3h^+ 3h^-$	(5.4 ±2.0)	$\times 10^{-4}$	DESIG=21
Γ ₈₃	$\gamma 4h^+ 4h^-$	(7.4 ±3.5)	$\times 10^{-4}$	DESIG=22
Γ ₈₄	$\gamma\pi^+\pi^- K^+ K^-$	(2.9 ±0.9)	$\times 10^{-4}$	DESIG=14
Γ ₈₅	$\gamma 2\pi^+ 2\pi^-$	(2.5 ±0.9)	$\times 10^{-4}$	DESIG=13
Γ ₈₆	$\gamma 3\pi^+ 3\pi^-$	(2.5 ±1.2)	$\times 10^{-4}$	DESIG=17
Γ ₈₇	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	(2.4 ±1.2)	$\times 10^{-4}$	DESIG=18
Γ ₈₈	$\gamma\pi^+\pi^- p\bar{p}$	(1.5 ±0.6)	$\times 10^{-4}$	DESIG=15
Γ ₈₉	$\gamma 2\pi^+ 2\pi^- p\bar{p}$	(4 ±6)	$\times 10^{-5}$	DESIG=19
Γ ₉₀	$\gamma 2K^+ 2K^-$	(2.0 ±2.0)	$\times 10^{-5}$	DESIG=16
Γ ₉₁	$\gamma\eta'(958)$	< 1.9	$\times 10^{-6}$	CL=90% DESIG=55
Γ ₉₂	$\gamma\eta$	< 1.0	$\times 10^{-6}$	CL=90% DESIG=54
Γ ₉₃	$\gamma f_0(980)$	< 3	$\times 10^{-5}$	CL=90% DESIG=105
Γ ₉₄	$\gamma f_2'(1525)$	(2.9 ±0.6)	$\times 10^{-5}$	DESIG=52
Γ ₉₅	$\gamma f_2(1270)$	(1.01 ±0.06)	$\times 10^{-4}$	DESIG=51
Γ ₉₆	$\gamma\eta(1405)$	< 8.2	$\times 10^{-5}$	CL=90% DESIG=65
Γ ₉₇	$\gamma f_0(1500)$	< 1.5	$\times 10^{-5}$	CL=90% DESIG=108
Γ ₉₈	$\gamma f_0(1500) \rightarrow \gamma K^+ K^-$	(1.0 ±0.4)	$\times 10^{-5}$	DESIG=192
Γ ₉₉	$\gamma f_0(1710)$	< 2.6	$\times 10^{-4}$	CL=90% DESIG=53
Γ ₁₀₀	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	(1.01 ±0.32)	$\times 10^{-5}$	DESIG=112
Γ ₁₀₁	$\gamma f_0(1710) \rightarrow \gamma\pi^+\pi^-$	(5.3 ±2.0)	$\times 10^{-6}$	DESIG=191
Γ ₁₀₂	$\gamma f_0(1710) \rightarrow \gamma\pi^0\pi^0$	< 1.4	$\times 10^{-6}$	CL=90% DESIG=109
Γ ₁₀₃	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	< 1.8	$\times 10^{-6}$	CL=90% DESIG=110
Γ ₁₀₄	$\gamma f_4(2050)$	< 5.3	$\times 10^{-5}$	CL=90% DESIG=104
Γ ₁₀₅	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	< 2	$\times 10^{-4}$	CL=90% DESIG=69
Γ ₁₀₆	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	< 8	$\times 10^{-7}$	CL=90% DESIG=60
Γ ₁₀₇	$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	< 6	$\times 10^{-7}$	CL=90% DESIG=61
Γ ₁₀₈	$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	< 1.1	$\times 10^{-6}$	CL=90% DESIG=62
Γ ₁₀₉	$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	< 3	$\times 10^{-3}$	CL=90% DESIG=68
Γ ₁₁₀	$\gamma\eta_c(1S)$	< 2.9	$\times 10^{-5}$	CL=90% DESIG=119
Γ ₁₁₁	$\gamma\eta_c(2S)$	< 4	$\times 10^{-4}$	CL=90% DESIG=193
Γ ₁₁₂	$\gamma\chi_{c0}$	< 6.6	$\times 10^{-5}$	CL=90% DESIG=120
Γ ₁₁₃	$\gamma\chi_{c1}$	(4.7 ^{+2.4} _{-1.9})	$\times 10^{-5}$	DESIG=121
Γ ₁₁₄	$\gamma\chi_{c2}$	< 7.6	$\times 10^{-6}$	CL=90% DESIG=122
Γ ₁₁₅	$\gamma\chi_{c1}(3872)$	< 4	$\times 10^{-5}$	CL=90% DESIG=195
Γ ₁₁₆	$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.8	$\times 10^{-6}$	CL=90% DESIG=124
Γ ₁₁₇	$\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi$	< 3.0	$\times 10^{-6}$	CL=90% DESIG=125
Γ ₁₁₈	$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 2.2	$\times 10^{-6}$	CL=90% DESIG=126
Γ ₁₁₉	$\gamma X\bar{X} (m_X < 3.1 \text{ GeV})$	[c] < 1	$\times 10^{-3}$	CL=90% DESIG=67
Γ ₁₂₀	$\gamma X\bar{X} (m_X < 4.5 \text{ GeV})$	[d] < 2.4	$\times 10^{-4}$	CL=90% DESIG=127
Γ ₁₂₁	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[e] < 1.78	$\times 10^{-4}$	CL=95% DESIG=113
Γ ₁₂₂	γA^0	[f]		DESIG=66
Γ ₁₂₃	$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	[g] < 9	$\times 10^{-6}$	CL=90% DESIG=114
Γ ₁₂₄	$\gamma A^0 \rightarrow \gamma\tau^+\tau^-$	[a] < 1.30	$\times 10^{-4}$	CL=90% DESIG=115
Γ ₁₂₅	$\gamma A^0 \rightarrow \gamma g g$	[h] < 1	%	CL=90% DESIG=129
Γ ₁₂₆	$\gamma A^0 \rightarrow \gamma s\bar{s}$	[h] < 1	$\times 10^{-3}$	CL=90% DESIG=130

Lepton Family number (LF) violating modes

				NODE=M049;CLUMP=C
Γ ₁₂₇	$e^\pm \mu^\mp$	LF	< 3.9	$\times 10^{-7}$ CL=90% DESIG=196
Γ ₁₂₈	$\mu^\pm \tau^\mp$	LF	< 2.7	$\times 10^{-6}$ CL=90% DESIG=116
Γ ₁₂₉	$e^\pm \tau^\mp$	LF	< 2.7	$\times 10^{-6}$ CL=90% DESIG=197
Γ ₁₃₀	$\gamma e^\pm \mu^\mp$	LF	< 4.2	$\times 10^{-7}$ CL=90% DESIG=198
Γ ₁₃₁	$\gamma \mu^\pm \tau^\mp$	LF	< 6.1	$\times 10^{-6}$ CL=90% DESIG=199
Γ ₁₃₂	$\gamma e^\pm \tau^\mp$	LF	< 6.5	$\times 10^{-6}$ CL=90% DESIG=200

Other decays

Γ_{133} invisible $< 3.0 \times 10^{-4}$ CL=90%
 Γ_{134} hadrons $(96 \pm 4) \%$

NODE=M049;CLUMP=D
 DESIG=106
 DESIG=101

[a] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV

[b] 2 GeV $< m_{K^+K^-} < 3$ GeV

[c] $X\bar{X}$ = vectors with $m < 3.1$ GeV

[d] X and \bar{X} = zero spin with $m < 4.5$ GeV

[e] 1.5 GeV $< m_X < 5.0$ GeV

[f] A^0 = scalar with $m < 8.0$ GeV

[g] 201 MeV $< M(\mu^+\mu^-) < 3565$ MeV

[h] 0.5 GeV $< m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

LINKAGE=E49

LINKAGE=G49

LINKAGE=B49

LINKAGE=F49

LINKAGE=C49

LINKAGE=A49

LINKAGE=D49

LINKAGE=I49

 $\Upsilon(1S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M049218

 $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_3\Gamma_2/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
31.2±1.6±1.7	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M049G1
 NODE=M049G1

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{134}\Gamma_2/\Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.240±0.016 OUR AVERAGE			
1.252±0.004±0.019	¹ ROSNER	06	CLEO $9.5 e^+e^- \rightarrow \text{hadrons}$
1.187±0.023±0.031	¹ BARU	92B	MD1 $e^+e^- \rightarrow \text{hadrons}$
1.23 ±0.02 ±0.05	¹ JAKUBOWSKI	88	CBAL $e^+e^- \rightarrow \text{hadrons}$
1.37 ±0.06 ±0.09	² GILES	84B	CLEO $e^+e^- \rightarrow \text{hadrons}$
1.23 ±0.08 ±0.04	² ALBRECHT	82	DASP $e^+e^- \rightarrow \text{hadrons}$
1.13 ±0.07 ±0.11	² NICZYPORUK	82	LENA $e^+e^- \rightarrow \text{hadrons}$
1.09 ±0.25	² BOCK	80	CNTR $e^+e^- \rightarrow \text{hadrons}$
1.35 ±0.14	³ BERGER	79	PLUT $e^+e^- \rightarrow \text{hadrons}$

NODE=M049G2
 NODE=M049G2

¹ Radiative corrections evaluated following KURAEV 85.

² Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

³ Radiative corrections reevaluated by ALEXANDER 89 using $B(\mu\mu) = 0.026$.

NODE=M049G2;LINKAGE=B
 NODE=M049G2;LINKAGE=R
 NODE=M049G2;LINKAGE=P

 $\Upsilon(1S)$ PARTIAL WIDTHS

NODE=M049220

 $\Gamma(e^+e^-)$ **Γ_2**

VALUE (keV)	DOCUMENT ID
1.340±0.018 OUR EVALUATION	

NODE=M049W2
 NODE=M049W2
 → UNCHECKED ←

 $\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.60±0.10 OUR AVERAGE				
2.53±0.13±0.04	60k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(1S) \rightarrow \tau^+\tau^-$
2.61±0.12 ^{+0.09} _{-0.13}	25k	CINABRO	94B	CLE2 $e^+e^- \rightarrow \tau^+\tau^-$
2.7 ±0.4 ±0.2		² ALBRECHT	85C	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±0.4		GILES	83	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

NODE=M049R3
 NODE=M049R3

¹ BESSON 07 reports $[\Gamma(\Upsilon(1S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

NODE=M049R3;LINKAGE=BE

NODE=M049R3;LINKAGE=A

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.39±0.08 OUR AVERAGE				
2.40±0.01±0.12	191k	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.29±0.08±0.11		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.42±0.14±0.14	307	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.8 ±0.3 ±0.2	826	BESSON	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
5.1 ±3.0		BERGER	80C	PLUT $e^+e^- \rightarrow e^+e^-$

NODE=M049R2
 NODE=M049R2

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.48±0.04 OUR AVERAGE				
2.46±0.01±0.11	246k	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.49±0.02±0.07	345k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
2.49±0.08±0.13		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.12±0.20±0.10		¹ BARU	92	MD1 $e^+e^- \rightarrow \mu^+\mu^-$
2.31±0.12±0.10		¹ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
2.52±0.07±0.07		CHEN	89B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
2.61±0.09±0.11		KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
2.30±0.25±0.13	86	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.9 ±0.3 ±0.2	864	BESSON	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.7 ±0.3 ±0.3		ANDREWS	83	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
3.2 ±1.3 ±0.3		ALBRECHT	82	DASP $e^+e^- \rightarrow \mu^+\mu^-$
3.8 ±1.5 ±0.2		NICZYPORUK	82	LENA $e^+e^- \rightarrow \mu^+\mu^-$
1.4 ^{+3.4} _{-1.4}		BOCK	80	CNTR $e^+e^- \rightarrow \mu^+\mu^-$
2.2 ±2.0		BERGER	79	PLUT $e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.NODE=M049R1
NODE=M049R1

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_1/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.008±0.023 OUR AVERAGE				
1.005±0.013±0.022	0.7M	¹ DEL-AMO-SA..10c	BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^- \Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(1S)$

¹ Allows any number of extra photons with total energy < 500 MeV.NODE=M049R43
NODE=M049R43

NODE=M049R43;LINKAGE=DE

 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
81.7±0.7				
	20M	¹ BESSON	06A	CLEO $\Upsilon(1S) \rightarrow \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ from BESSON 06A and PDG 08 values of $B(\mu^+\mu^-) = (2.48 \pm 0.05)\%$ and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.NODE=M049R35
NODE=M049R35

NODE=M049R35;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.60				
	400k	¹ BESSON	06A	CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$

¹ Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ and $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.NODE=M049R36
NODE=M049R36

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$ Γ_5/Γ_4

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.01±0.27				
	20M	BESSON	06A	CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M049R37
NODE=M049R37 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0294±0.0024 OUR AVERAGE			
0.030 ±0.002 ±0.002	AQUINES	06A	CLE3 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

NODE=M049R73
NODE=M049R73 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.4 ±0.4 OUR FIT Error includes scale factor of 1.4.					
5.4 ±0.4 OUR AVERAGE Error includes scale factor of 1.5.					
5.25±0.13±0.25		3k	SHEN	16	BELL $e^+e^- \rightarrow J/\psi X$
6.4 ±0.4 ±0.6		730	BRIERE	04	CLEO $e^+e^- \rightarrow J/\psi X$
11 ±4 ±2			¹ FULTON	89	CLEO $e^+e^- \rightarrow \mu^+\mu^- X$

NODE=M049R12
NODE=M049R12

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	ALBRECHT	92J	ARG	$e^+e^- \rightarrow e^+e^-X$, $\mu^+\mu^-X$
<17	90	MASCHMANN	90	CBAL	$e^+e^- \rightarrow \text{hadrons}$
<200	90	NICZYPORUK	83	LENA	

¹ Using $B((J/\psi) \rightarrow \mu^+\mu^-) = (6.9 \pm 0.9)\%$.

NODE=M049R12;LINKAGE=K

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R85
NODE=M049R85

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R86
NODE=M049R86

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10 ⁻⁶)	EVT%	DOCUMENT ID	TECN	COMMENT
3.90 ± 1.21 ± 0.23	20	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R87
NODE=M049R87

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R88
NODE=M049R88

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R89
NODE=M049R89

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R90
NODE=M049R90

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R91
NODE=M049R91

$\Gamma(X(4350) \text{ anything}, X \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.1 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P05
NODE=M049P05

$\Gamma(T_{c\bar{c}1}(3900)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P06
NODE=M049P06

$\Gamma(T_{c\bar{c}1}(4200)^\pm \text{ anything}, Z_c \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6.0 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P07
NODE=M049P07

$\Gamma(T_{c\bar{c}1}(4430)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.9 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P08
NODE=M049P08

$\Gamma(X_{cs}^\pm \text{ anything}, X \rightarrow J/\psi K^\pm)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.7 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^- X$

NODE=M049P11
NODE=M049P11

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.8 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R99
NODE=M049R99

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.5 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P03
NODE=M049P03

$\Gamma(\chi_{c1}(4140) \text{ anything}, \chi_{c1} \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-6}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P04
 NODE=M049P04

 $\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{23}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.4	90	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R25
 NODE=M049R25

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.90±0.35 OUR FIT				
1.90±0.43±0.14	215	JIA	17	BELL $\Upsilon(1S) \rightarrow \gamma J/\psi(1S)$

NODE=M049P13
 NODE=M049P13

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{24}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.07 OUR FIT				
0.35±0.08±0.06	52 ± 12	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R26
 NODE=M049R26

 $\Gamma(\chi_{c1}(1P)\chi_{tetra})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<37.8 \times 10^{-6}$	90	¹ JIA	17A	BELL $e^+ e^- \rightarrow \text{hadrons}$

NODE=M049P15
 NODE=M049P15

¹ For a tetraquark state χ_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of χ_{tetra} mass and width range from 4.4×10^{-6} to 37.8×10^{-6} .

NODE=M049P15;LINKAGE=A

 $\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{26}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.52±0.12±0.09	47 ± 11	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R27
 NODE=M049R27

 $\Gamma(\psi(2S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.23±0.17±0.11	215	SHEN	16	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049P12
 NODE=M049P12

 $\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{27}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.11±0.08	42 ± 11	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R28
 NODE=M049R28

 $\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.6 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R92
 NODE=M049R92

 $\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.5 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R93
 NODE=M049R93

 $\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.5 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R94
 NODE=M049R94

 $\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R95
 NODE=M049R95

 $\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R96
 NODE=M049R96

 $\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R97
 NODE=M049R97

 $\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R98
 NODE=M049R98

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{35}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.9 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P00
NODE=M049P00 **$\Gamma(\psi(4360) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$** **$\Gamma_{36}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P01
NODE=M049P01 **$\Gamma(\psi(4660) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$** **$\Gamma_{37}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P02
NODE=M049P02 **$\Gamma(T_{c\bar{c}}(4050)^\pm \text{ anything}, X \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$** **$\Gamma_{38}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.8 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P09
NODE=M049P09 **$\Gamma(T_{c\bar{c}1}(4430)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$** **$\Gamma_{39}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.7 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P10
NODE=M049P10 **$\Gamma(\chi_{c1}(3872) \text{ anything})/\Gamma_{\text{total}}$** **$\Gamma_{40}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-4}$ (CL = 90%)				$[\leq 2.7 \times 10^{-4}$ (CL = 90%) OUR 2024 BEST LIMIT]
$<2.2 \times 10^{-4}$	90	¹ SHEN	16	BELL $\Upsilon(1S) \rightarrow$ $J/\psi\pi^+\pi^- X$

NODE=M049P31
NODE=M049P31

¹ SHEN 16 reports $[\Gamma(\Upsilon(1S) \rightarrow \chi_{c1}(3872) \text{ anything})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] < 9.5 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.

NODE=M049P31;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-)/\Gamma_{\text{total}}$ **Γ_{41}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<22.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P17
NODE=M049P17

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi\pi^\pm) = 1$.

NODE=M049P17;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp)/\Gamma_{\text{total}}$ **Γ_{42}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.1 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P18
NODE=M049P18

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi\pi^\pm) = 1 = B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm)$.

NODE=M049P18;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-)/\Gamma_{\text{total}}$ **Γ_{43}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.8 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P19
NODE=M049P19

¹ Assuming $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm) = 1$

NODE=M049P19;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-)/\Gamma_{\text{total}}$ **Γ_{44}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<15.8 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P20
NODE=M049P20

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P20;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-)/\Gamma_{\text{total}}$ **Γ_{45}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<26.6 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P21
NODE=M049P21

¹ Assuming $B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P21;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp)/\Gamma_{\text{total}}$ **Γ_{46}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<44.2 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P22
NODE=M049P22

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1 = B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm)$

NODE=M049P22;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-)/\Gamma_{\text{total}}$ **Γ_{47}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<20.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P23
NODE=M049P23

¹ Assuming $B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M049P23;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<23.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M049P25
NODE=M049P25

NODE=M049P25;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4430)^\mp)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<45.5 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1 = B(T_{c\bar{c}}(4430)^\pm \rightarrow \psi(2S)\pi^\pm)$

NODE=M049P26
NODE=M049P26

NODE=M049P26;LINKAGE=A

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.68	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1 \times 10^3$	90	BLINOV	90	MD1 $\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2 \times 10^2$	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2.1 \times 10^3$	90	NICZYPORUK	83	LENA $\Upsilon(1S) \rightarrow \rho^0\pi^0$

NODE=M049R11
NODE=M049R11

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.90	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M049R05
NODE=M049R05

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow \pi^+\pi^-$

NODE=M049R57
NODE=M049R57

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow K^+K^-$

NODE=M049R58
NODE=M049R58

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ BARU	96	MD1 $\Upsilon(1S) \rightarrow p\bar{p}$

¹ Supersedes BARU 92 in this node.

NODE=M049R59
NODE=M049R59

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.14 \pm 0.72 \pm 0.34$		26 ± 9	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18.4	90	ANASTASSOV	99	CLE2 $e^+e^- \rightarrow \text{hadrons}$
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NODE=M049R72
NODE=M049R72

 $\Gamma(\phi K^+K^-)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.36 \pm 0.37 \pm 0.29$	56	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^+K^-)$

NODE=M049R75
NODE=M049R75

 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.46 \pm 0.67 \pm 0.72$	64	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M049R76
NODE=M049R76

 $\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.42 \pm 0.50 \pm 0.58$	173	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M049R77
NODE=M049R77

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^+K^-)$

NODE=M049R78
NODE=M049R78

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.79	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M049R79
NODE=M049R79

$$\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}} \quad \Gamma_{61}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.24	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M049R80
NODE=M049R80

$$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{62}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.02 \pm 0.68 \pm 0.34$	42	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R81
NODE=M049R81

$$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}} \quad \Gamma_{63}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.41	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R82
NODE=M049R82

$$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}} \quad \Gamma_{64}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.02 \pm 0.35 \pm 0.22$	24	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M049R83
NODE=M049R83

$$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}} \quad \Gamma_{65}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.25	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M049R84
NODE=M049R84

$$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{66}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$12.8 \pm 2.0 \pm 2.3$	143 \pm 22	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

NODE=M049R06
NODE=M049R06

$$\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{67}/\Gamma$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.59 \pm 0.33 \pm 0.18$		37 \pm 8	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R07
NODE=M049R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.4	90	¹ DOBBS	12A	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$
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¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R07;LINKAGE=DO

$$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{68}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.92 \pm 0.85 \pm 0.37$	16 \pm 5	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R08
NODE=M049R08

$$\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{69}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.11	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R09
NODE=M049R09

$$\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{70}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.6 \pm 2.8 \pm 1.3$	3.1k	JIA	17A	BELL $e^+ e^- \rightarrow \text{hadrons}$

NODE=M049P14
NODE=M049P14

$$\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{71}/\Gamma$$

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$25.2 \pm 1.3 \pm 1.5$		\approx 2k	¹ AUBERT	10C	BABR $\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049R32
NODE=M049R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	² ALBRECHT	92J	ARG $e^+ e^- \rightarrow D^0 \pi^\pm X$
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¹ For $x_p > 0.1$.

² For $x_p > 0.2$.

NODE=M049R32;LINKAGE=AU

NODE=M049R32;LINKAGE=B

$$\Gamma(f_1(1285) X_{tetra})/\Gamma_{\text{total}} \quad \Gamma_{72}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<62.4 \times 10 ⁻⁶	90	¹ JIA	17A	BELL $e^+ e^- \rightarrow \text{hadrons}$

NODE=M049P16
NODE=M049P16

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.6×10^{-6} to 62.4×10^{-6} .

NODE=M049P16;LINKAGE=A

$\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{73}/Γ
2.85±0.25 OUR AVERAGE					
$2.81 \pm 0.49^{+0.20}_{-0.24}$		LEES	14G	BABR $e^+ e^- \rightarrow \overline{2H} X$	OCCUR=2
$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07	CLEO $e^+ e^- \rightarrow \overline{2H} X$	

NODE=M049R33
NODE=M049R33

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT	Γ_{74}/Γ
1.200±0.017	1,2 DOBBS	12A $\Upsilon(1S) \rightarrow \text{hadrons}$	

NODE=M049R02
NODE=M049R02

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

NODE=M049R02;LINKAGE=DO

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R02;LINKAGE=NC

 $\Gamma(ggg, \gamma gg \rightarrow \bar{d} \text{ anything})/\Gamma(ggg, \gamma gg \rightarrow \text{anything})$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{75}/Γ
3.36±0.23±0.25	455	ASNER	07	CLEO $e^+ e^- \rightarrow \bar{d} X$	

NODE=M049R34
NODE=M049R34

 $\Gamma(\gamma\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	Γ_{75}/Γ
6.3±1.2±1.3	¹ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R70
NODE=M049R70

¹ For $m_{\pi\pi} > 1$ GeV.

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	Γ_{76}/Γ
1.7±0.6±0.3	¹ ANASTASSOV 99	CLE2	$e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R71
NODE=M049R71

¹ For $m_{\pi\pi} > 1$ GeV.

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma\pi\pi(\text{S-wave}))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	Γ_{77}/Γ
4.63±0.56±0.48	LEES	18A	BABR $\Upsilon(1S) \rightarrow \gamma\pi^+\pi^-$	

NODE=M049P27
NODE=M049P27

 $\Gamma(\gamma\pi^0\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{78}/Γ
<2.4	90	¹ BESSON	07A	CLEO $e^+ e^- \rightarrow \Upsilon(1S)$	

NODE=M049R47
NODE=M049R47

¹ BESSON 07A obtained this limit for $0.7 < m_{\pi^0\eta} < 3$ GeV.

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+ K^-)/\Gamma_{\text{total}}$

($2 < m_{K^+ K^-} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{79}/Γ
1.14±0.08±0.10	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$	

NODE=M049R24
NODE=M049R24

NODE=M049R24
NODE=M049R24

 $\Gamma(\gamma p\bar{p})/\Gamma_{\text{total}}$

($2 < m_{p\bar{p}} < 3$ GeV)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{80}/Γ
<0.6	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma p\bar{p}$	

NODE=M049R29

NODE=M049R29
NODE=M049R29

 $\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{81}/Γ
7.0±1.1±1.0	80 ± 12	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R20
NODE=M049R20

 $\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{82}/Γ
5.4±1.5±1.3	39 ± 11	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R21
NODE=M049R21

 $\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{83}/Γ
7.4±2.5±2.5	36 ± 12	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R22
NODE=M049R22

 $\Gamma(\gamma\pi^+\pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{84}/Γ
2.9±0.7±0.6	29 ± 8	FULTON	90B	CLEO $e^+ e^- \rightarrow \text{hadrons}$	

NODE=M049R14
NODE=M049R14

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{85}/Γ NODE=M049R13
NODE=M049R13**2.5±0.7±0.5** 26 ± 7FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{86}/Γ NODE=M049R17
NODE=M049R17**2.5±0.9±0.8** 17 ± 5FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{87}/Γ NODE=M049R18
NODE=M049R18**2.4±0.9±0.8** 18 ± 7FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{88}/Γ NODE=M049R15
NODE=M049R15**1.5±0.5±0.3** 22 ± 6FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma 2\pi^+ 2\pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{89}/Γ NODE=M049R19
NODE=M049R19**0.4±0.4±0.4** 7 ± 6FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{90}/Γ NODE=M049R16
NODE=M049R16**0.2±0.2** 2 ± 2FULTON 90B CLEO $e^+ e^- \rightarrow$ hadrons $\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{91}/Γ NODE=M049R55
NODE=M049R55< 1.9 90 ATHAR 07A CLEO $\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \pi^+ \pi^- \eta, \gamma \rho$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16 90 RICHICHI 01B CLE2 $\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \eta \pi^+ \pi^-$ $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{92}/Γ NODE=M049R54
NODE=M049R54< 1.0 90 ATHAR 07A CLEO $\Upsilon(1S) \rightarrow \gamma \eta \rightarrow \gamma \gamma \gamma, \gamma \pi^+ \pi^- \pi^0, \gamma 3\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21 90 MASEK 02 CLEO $\Upsilon(1S) \rightarrow \gamma \eta$ $\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{93}/Γ NODE=M049R31
NODE=M049R31<3 90 ¹ATHAR 06 CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$ ¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 1$.

NODE=M049R31;LINKAGE=AT

 $\Gamma(\gamma f_2'(1525))/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{94}/Γ NODE=M049R52
NODE=M049R52**2.9 ± 0.6 OUR AVERAGE**

2.13±0.28±0.72

¹ LEES 18A BABR $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

4.0 ± 1.4 ± 0.1 17

² BESSON 11 CLEO $\Upsilon(1S) \rightarrow K_S^0 K_S^0$ 3.7 ^{+0.9} ± 0.8ATHAR 06 CLE3 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

-0.7

• • • We do not use the following data for averages, fits, limits, etc. • • •

<14 90 ³FULTON 90B CLEO $\Upsilon(1S) \rightarrow \gamma K^+ K^-$ <19.4 90 ³ALBRECHT 89 ARG $\Upsilon(1S) \rightarrow \gamma K^+ K^-$ ¹ Using $B(f_2'(1525) \rightarrow K\bar{K}) = 0.887 \pm 0.022$ and $B(K^0 \bar{K}^0) = 1/2 B(K\bar{K})$.² BESSON 11 reports $(4.0 \pm 1.3 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\Upsilon(1S) \rightarrow \gamma f_2'(1525))/\Gamma_{\text{total}}] \times [B(f_2'(1525) \rightarrow K\bar{K})]$ assuming $B(f_2'(1525) \rightarrow K\bar{K}) = (88.8 \pm 3.1) \times 10^{-2}$, which we rescale to our best value $B(f_2'(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The result also assumes $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$ and $B(f_2'(1525) \rightarrow K\bar{K}) = 4 B(f_2'(1525) \rightarrow K_S^0 K_S^0)$.³ Assuming $B(f_2'(1525) \rightarrow K\bar{K}) = 0.71$.NODE=M049R52;LINKAGE=A
NODE=M049R52;LINKAGE=BE

NODE=M049R52;LINKAGE=D

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{95}/Γ
10.1 ± 0.6				OUR AVERAGE	
10.15 ± 0.59 ^{+0.54} _{-0.43}		¹ LEES	18A BABR	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$	
10.5 ± 1.6 ^{+1.9} _{-1.8}		² BESSON	07A CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$	
10.2 ± 0.8 ± 0.7		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$	
8.1 ± 2.3 ^{+2.9} _{-2.7}		³ ANASTASSOV	99 CLE2	$e^+ e^- \rightarrow \text{hadrons}$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	³ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$	
<13	90	³ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$	
<81	90	SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$	
¹ Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = 1/3 B(f_2(1270) \rightarrow \pi \pi)$ and $B(f_2(1270) \rightarrow \pi \pi) = (84.2^{+2.9}_{-0.9})\%$.					
² Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = B(f_2(1270) \rightarrow \pi \pi)/3$ and $B(f_2(1270) \rightarrow \pi \pi) = (84.7^{+2.5}_{-1.2})\%$.					
³ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.					

NODE=M049R51
NODE=M049R51

NODE=M049R51;LINKAGE=A

NODE=M049R51;LINKAGE=BE

NODE=M049R51;LINKAGE=C

 $\Gamma(\gamma \eta(1405))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{96}/Γ
<8.2	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$	
¹ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.					

NODE=M049R23
NODE=M049R23

NODE=M049R23;LINKAGE=J

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{97}/Γ
<1.5	90	¹ BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.1	90	² BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$	OCCUR=2
¹ Using $B(f_0(1500) \rightarrow \pi^0 \pi^0) = B(f_0(1500) \rightarrow \pi \pi)/3$ and $B(f_0(1500) \rightarrow \pi \pi) = (0.349 \pm 0.023)\%$.					
² Calculated by us using $B(f_0(1500) \rightarrow \eta \eta) = (5.1 \pm 0.9)\%$.					

NODE=M049R44
NODE=M049R44

NODE=M049R44;LINKAGE=BE

NODE=M049R44;LINKAGE=BS

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT	Γ_{98}/Γ
1.04 ± 0.14 ± 0.33	¹ LEES	18A BABR	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$	
¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1500) \rightarrow \gamma K \bar{K}) = (2.08 \pm 0.27 \pm 0.65) \times 10^{-5}$ assuming $B(K^0 \bar{K}^0) = 1/2 B(K \bar{K})$.				

NODE=M049P29
NODE=M049P29

NODE=M049P29;LINKAGE=A

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{99}/Γ
< 2.6	90	¹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$	
< 19	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$	OCCUR=2
< 8	90	² ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$	OCCUR=2
< 24	90	³ SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$	
¹ Assuming $B(f_0(1710) \rightarrow K \bar{K}) = 0.38$.					
² Assuming $B(f_0(1710) \rightarrow \pi \pi) = 0.04$.					
³ Assuming $B(f_0(1710) \rightarrow \eta \eta) = 0.18$.					

NODE=M049R53
NODE=M049R53

NODE=M049R53;LINKAGE=E

NODE=M049R53;LINKAGE=F

NODE=M049R53;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{100}/Γ
1.01 ± 0.26 ± 0.18		¹ LEES	18A BABR	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.7	90	ATHAR	06 CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$	
¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1710) \rightarrow \gamma K \bar{K}) = (2.02 \pm 0.51 \pm 0.35) \times 10^{-5}$ assuming $B(K^0 \bar{K}^0) = 1/2 B(K \bar{K})$.					

NODE=M049R50
NODE=M049R50

NODE=M049R50;LINKAGE=A

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{101} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.53 \pm 0.17 \pm 0.11$	¹ LEES	18A	BABR $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1710) \rightarrow \gamma \pi \pi) = (0.79 \pm 0.26 \pm 0.17) \times 10^{-5}$ assuming $B(\pi^0 \pi^0) = 1/3 B(\pi \pi)$.			

NODE=M049P28
NODE=M049P28

NODE=M049P28;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{102} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	BESSON	07A	CLEO $e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$

NODE=M049R45
NODE=M049R45 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{103} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	BESSON	07A	CLEO $e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$

NODE=M049R46
NODE=M049R46 $\Gamma(\gamma f_4(2050)) / \Gamma_{\text{total}}$ Γ_{104} / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5.3	90	¹ ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
¹ Assuming $B(f_4(2050) \rightarrow \pi \pi) = 0.17$.				

NODE=M049R30
NODE=M049R30

NODE=M049R30;LINKAGE=AT

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K^+ K^-) / \Gamma_{\text{total}}$ Γ_{105} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0002	90	BARU	89	MD1 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R63
NODE=M049R63 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K^+ K^-) / \Gamma_{\text{total}}$ Γ_{106} / Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 8	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 160	90	MASEK	02	CLEO $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 150	90	FULTON	90B	CLEO $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 290	90	ALBRECHT	89	ARG $\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<2000	90	BARU	89	MD1 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R56
NODE=M049R56 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{107} / Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<120	90	MASEK	02	CLEO $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M049R41
NODE=M049R41 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p}) / \Gamma_{\text{total}}$ Γ_{108} / Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 11	90	ATHAR	06	CLE3 $\Upsilon(1S) \rightarrow \gamma p \bar{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<160	90	MASEK	02	CLEO $\Upsilon(1S) \rightarrow \gamma p \bar{p}$

NODE=M049R42
NODE=M049R42 $\Gamma(\gamma \eta(2225) \rightarrow \gamma \phi \phi) / \Gamma_{\text{total}}$ Γ_{109} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.003	90	BARU	89	MD1 $\Upsilon(1S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M049R62
NODE=M049R62 $\Gamma(\gamma \eta_c(1S)) / \Gamma_{\text{total}}$ Γ_{110} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.9 $\times 10^{-5}$	90	¹ KATRENKO	20	BELL $e^+ e^- \rightarrow \gamma + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<5.7 $\times 10^{-5}$	90	SHEN	10A	BELL $\Upsilon(1S) \rightarrow \gamma X$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-$ decays.				

NODE=M049R38
NODE=M049R38

NODE=M049R38;LINKAGE=A

 $\Gamma(\gamma \eta_c(2S)) / \Gamma_{\text{total}}$ Γ_{111} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4 $\times 10^{-4}$	90	¹ KATRENKO	20	BELL $e^+ e^- \rightarrow \gamma + \text{hadrons}$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-$ decays.				

NODE=M049P30
NODE=M049P30

NODE=M049P30;LINKAGE=A

$\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-5}$	90	¹ KATRENKO 20	BELL	$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
••• We do not use the following data for averages, fits, limits, etc. •••				
$<6.5 \times 10^{-4}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.				

 Γ_{112}/Γ NODE=M049R39
NODE=M049R39

NODE=M049R39;LINKAGE=A

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.7^{+2.4+0.4}_{-1.8-0.5}$		5	¹ KATRENKO 20	BELL	$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
••• We do not use the following data for averages, fits, limits, etc. •••					
<2.3	90		SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.					

 Γ_{113}/Γ NODE=M049R40
NODE=M049R40

NODE=M049R40;LINKAGE=A

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.6 \times 10^{-6}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
••• We do not use the following data for averages, fits, limits, etc. •••				
$<3.3 \times 10^{-5}$	90	¹ KATRENKO 20	BELL	$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.				

 Γ_{114}/Γ NODE=M049R48
NODE=M049R48

NODE=M049R48;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-5}$ (CL = 90%)		[$<5 \times 10^{-5}$ (CL = 90%) OUR 2024 BEST LIMIT]		
$<4 \times 10^{-5}$	90	¹ SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ SHEN 10A reports $[\Gamma(\Upsilon(1S) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.				

 Γ_{115}/Γ NODE=M049P32
NODE=M049P32

NODE=M049P32;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-6}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{116}/Γ NODE=M049R68
NODE=M049R68 $\Gamma(\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{117}/Γ NODE=M049R69
NODE=M049R69 $\Gamma(\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{118}/Γ NODE=M049R74
NODE=M049R74 $\Gamma(\gamma X \bar{X} (m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ $(X \bar{X} = \text{vectors with } m < 3.1 \text{ GeV})$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	¹ BALEST 95	CLEO	$e^+e^- \rightarrow \gamma + X \bar{X}$

 Γ_{119}/Γ NODE=M049R61
NODE=M049R61
NODE=M049R61

NODE=M049R61;LINKAGE=A

 $\Gamma(\gamma X \bar{X} (m_X < 4.5 \text{ GeV}))/\Gamma_{\text{total}}$ $X \text{ and } \bar{X} = \text{zero spin with } m < 4.5 \text{ GeV}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	¹ DEL-AMO-SA..11J	BABR	$e^+e^- \rightarrow \gamma + X \bar{X}$

 Γ_{120}/Γ NODE=M049R01
NODE=M049R01
NODE=M049R01

NODE=M049R01;LINKAGE=DA

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ $(1.5 \text{ GeV} < m_X < 5.0 \text{ GeV})$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.78	95	ROSNER 07A	CLEO	$e^+e^- \rightarrow \gamma X$

 Γ_{121}/Γ NODE=M049R64
NODE=M049R64
NODE=M049R64

$\Gamma(\gamma A^0)/\Gamma_{\text{total}}$ $(A^0 = \text{scalar with } m < 8.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 4.5 \times 10^{-6}$	90	¹ DEL-AMO-SA...11J	BABR	$e^+e^- \rightarrow \gamma + X$
$< 3 \times 10^{-5}$	90	² BALEST	95 CLEO	$e^+e^- \rightarrow \gamma + X$
$< 5.6 \times 10^{-5}$	90	² ANTREASYAN 90c	CBAL	$e^+e^- \rightarrow \gamma + X$

¹ For a non-interacting scalar or pseudoscalar, A^0 , with mass $m_{A^0} < 8.0 \text{ GeV}$. 90% CL upper limits range from 1.9×10^{-6} to 4.5×10^{-6} .

² For any non-interacting long-lived particle with mass $< 7.2 \text{ GeV}$.

 Γ_{122}/Γ

NODE=M049R60

NODE=M049R60

NODE=M049R60

NODE=M049R60;LINKAGE=DA

NODE=M049R60;LINKAGE=A

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ $(201 < M(\mu^+ \mu^-) < 3565 \text{ MeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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< 9	90	¹ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 16	90	² JIA	22 BELL	$\Upsilon(2S) \rightarrow \gamma \mu^+ \mu^- \pi^+ \pi^-$
< 9.7	90	³ LEES	13C BABR	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with $201 < M(\mu^+ \mu^-) < 3565 \text{ MeV}$, excluding J/ψ . Measured 90% CL limits as a function of $M(\mu^+ \mu^-)$ range from $1-9 \times 10^{-6}$.

² For a narrow scalar or pseudoscalar, A^0 , with $0.22 < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits ranging from 3.1×10^{-7} at $M(A^0) = 0.22 \text{ GeV}$ to 1.6×10^{-5} at $M(A^0) = 9.2 \text{ GeV}$.

³ For a narrow scalar or pseudoscalar, A^0 , with mass in the range $0.212-9.2 \text{ GeV}$, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} are in the range $0.28-9.7 \times 10^{-6}$.

 Γ_{123}/Γ

NODE=M049R65

NODE=M049R65

NODE=M049R65

NODE=M049R65;LINKAGE=LO

NODE=M049R65;LINKAGE=A

NODE=M049R65;LINKAGE=LE

 $\Gamma(\gamma A^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ $(2m_\tau < M(\tau^+ \tau^-) < 9.2 \text{ GeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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< 130	90	¹ LEES	13R BABR	$\Upsilon(2S) \rightarrow \gamma \tau^+ \tau^- \pi^+ \pi^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 150	90	² JIA	22 BELL	$\Upsilon(2S) \rightarrow \gamma \tau^+ \tau^- \pi^+ \pi^-$
< 50	90	³ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \tau^+ \tau^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits of 0.9×10^{-5} at $M(A^0) = 2m_\tau$, $\approx 1.5 \times 10^{-5}$ at $M(A^0) = 7.5 \text{ GeV}$, and 13×10^{-5} at $M(A^0) = 9.2 \text{ GeV}$.

² For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits ranging from 3.8×10^{-6} at $M(A^0) = 2m_\tau$ to 1.5×10^{-4} at $M(A^0) = 9.2 \text{ GeV}$.

³ For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 7.5 \text{ GeV}$, resulting in 90% CL limits ranging from 1×10^{-5} at $M(A^0)=2m_\tau$ to 5×10^{-5} at $M(A^0)=7.5 \text{ GeV}$.

 Γ_{124}/Γ

NODE=M049R66

NODE=M049R66

NODE=M049R66

NODE=M049R66;LINKAGE=A

NODE=M049R66;LINKAGE=B

NODE=M049R66;LINKAGE=LO

 $\Gamma(\gamma A^0 \rightarrow \gamma g g)/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1 \times 10^{-2}$	90	¹ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$
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¹ For a narrow, CP -odd pseudoscalar, A^0 , searched for in 26 hadronic decay modes with invariant mass $0.5 \text{ GeV} < m_{A^0} < 9.0 \text{ GeV}$. Measured 90% CL limits as a function of m_{A^0} range from 10^{-6} to 10^{-2} .

 Γ_{125}/Γ

NODE=M049R03

NODE=M049R03

NODE=M049R03

NODE=M049R03;LINKAGE=A

 $\Gamma(\gamma A^0 \rightarrow \gamma s \bar{s})/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1 \times 10^{-3}$	90	¹ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$
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¹ For a narrow, CP -odd pseudoscalar, A^0 , searched for in 14 hadronic decay modes with invariant mass $1.5 \text{ GeV} < m_{A^0} < 9.0 \text{ GeV}$. Measured 90% CL limits as a function of m_{A^0} range from 10^{-5} to 10^{-3} .

 Γ_{126}/Γ

NODE=M049R04

NODE=M049R04

NODE=M049R04

NODE=M049R04;LINKAGE=A

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M049230

 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{127}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
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< 3.9	90	PATRA	22 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^\pm \mu^\mp$
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NODE=M049P33

NODE=M049P33

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{128}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.7 \times 10^{-6}$	90	PATRA 22	BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^\pm \tau^\mp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$<6.0 \times 10^{-6}$	95	LOVE 08A	CLEO	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049R67
 NODE=M049R67

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{129}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	PATRA 22	BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^\pm \tau^\mp$

NODE=M049P34
 NODE=M049P34

 $\Gamma(\gamma e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	PATRA 22	BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma e^\pm \mu^\mp$

NODE=M049P35
 NODE=M049P35

 $\Gamma(\gamma \mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.1	90	PATRA 22	BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma \mu^\pm \tau^\mp$

NODE=M049P36
 NODE=M049P36

 $\Gamma(\gamma e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.5	90	PATRA 22	BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma e^\pm \tau^\mp$

NODE=M049P37
 NODE=M049P37

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.0	90	AUBERT 09AX	BABR	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<39	90	RUBIN 07	CLEO	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
<25	90	TAJIMA 07	BELL	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049235

NODE=M049R10
 NODE=M049R10

 $\Upsilon(1S)$ REFERENCES

AAIJ 24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
SHAMOV 23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
JIA 22	PRL 128 081804	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=61657
PATRA 22	JHEP 2205 095	S. Patra <i>et al.</i>	(BELLE Collab.)	REFID=61653
KATRENKO 20	PRL 124 122001	P. Katrenko <i>et al.</i>	(BELLE Collab.)	REFID=60544
JIA 18	PR D97 112004	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58949
LEES 18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58950
JIA 17	PR D95 012001	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=57635
JIA 17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
SHEN 16	PR D93 112013	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=57515
LEES 14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG 14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
LEES 13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54949
LEES 13L	PR D88 031701	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55167
LEES 13R	PR D88 071102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55451
SHEN 13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
DOBBS 12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN 12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
BESSION 11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=16737
DEL-AMO-SA... 11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16495
AUBERT 10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53211
DEL-AMO-SA... 10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53354
SHEN 10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AUBERT 09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53201
LOVE 08	PRL 101 151802	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52565
LOVE 08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG 08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER 07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
ATHAR 07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51945
BESSION 07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSION 07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51638
ROSNER 07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
RUBIN 07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)	REFID=51629
TAJIMA 07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=51645
AQUINES 06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51510
ATHAR 06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50993
BESSION 06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER 06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS 05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
BRIERE 04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50183
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MASEK 02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)	REFID=48846
RICHICHI 01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)	REFID=48345

NODE=M049

ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	
ANASTASSOV	99	PRL 82 286	A. Anastassov <i>et al.</i>	(CLEO Collab.)
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)
BALEST	95	PR D51 2053	R. Balest <i>et al.</i>	(CLEO Collab.)
CINABRO	94B	PL B340 129	D. Cinabro <i>et al.</i>	(CLEO Collab.)
ALBRECHT	92J	ZPHY C55 25	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BARU	92	ZPHY C54 229	S.E. Baru <i>et al.</i>	(NOVO)
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KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)
ANTREASYAN	90C	PL B251 204	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BLINOV	90	PL B245 311	A.E. Blinov <i>et al.</i>	(NOVO)
FULTON	90B	PR D41 1401	R. Fulton <i>et al.</i>	(CLEO Collab.)
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
FULTON	89	PL B224 445	R. Fulton <i>et al.</i>	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
		Editors: A. Ali and P. Soeding, World Scientific, Singapore		
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.) IGJPC
SCHMITT	88	ZPHY C40 199	P. Schmitt <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86	ZPHY C30 551	S.E. Baru <i>et al.</i>	(NOVO)
ALBRECHT	85C	PL 154B 452	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
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ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
BESSION	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
MACKAY	84	PR D29 2483	W.W. MacKay <i>et al.</i>	(CUSB Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GILES	83	PRL 50 877	R. Giles <i>et al.</i>	(HARV, OSU, ROCH, RUTG+)
NICZYPORUK	83	ZPHY C17 197	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)
ARTAMONOV	82	PL 118B 225	A.S. Artamonov <i>et al.</i>	(NOVO)
NICZYPORUK	82	ZPHY C15 299	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
BERGER	80C	PL 93B 497	C. Berger <i>et al.</i>	(PLUTO Collab.)
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)
BERGER	79	ZPHY C1 343	C. Berger <i>et al.</i>	(PLUTO Collab.)

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REFID=22263
REFID=22264
REFID=22259

NODE=M076

$$\chi_{b0}(1P)$$

$$J^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M076

$\chi_{b0}(1P)$ MASS

NODE=M076M

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>
9859.44 ± 0.42 ± 0.31 OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$
mass = 10023.26 ± 0.31 MeV	

NODE=M076M
→ UNCHECKED ←

$$m_{\chi_{b1}(1P)} - m_{\chi_{b0}(1P)}$$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
32.49 ± 0.93	LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M076M2
NODE=M076M2

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M076DM

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
162.5 ± 0.4 OUR AVERAGE			
162.56 ± 0.19 ± 0.42	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
162.0 ± 0.8 ± 1.2	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
162.1 ± 0.5 ± 1.4	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
163.8 ± 1.6 ± 2.7	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
158.0 ± 7 ± 1	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
149.4 ± 0.7 ± 5.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M076DM

$\chi_{b0}(1P)$ DECAY MODES

NODE=M076215;NODE=M076

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $\gamma \Upsilon(1S)$	(1.94±0.27) %		DESIG=1
Γ_2 $D^0 X$	< 10.4 %	90%	DESIG=2
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 $\times 10^{-4}$	90%	DESIG=3
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	< 5 $\times 10^{-5}$	90%	DESIG=4
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 $\times 10^{-4}$	90%	DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	< 2.1 $\times 10^{-4}$	90%	DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.1 ±0.6) $\times 10^{-4}$		DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 $\times 10^{-4}$	90%	DESIG=8
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 $\times 10^{-4}$	90%	DESIG=9
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 $\times 10^{-4}$	90%	DESIG=10
Γ_{11} $3\pi^+ 3\pi^-$	< 8 $\times 10^{-5}$	90%	DESIG=11
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	< 6 $\times 10^{-4}$	90%	DESIG=12
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	(2.4 ±1.2) $\times 10^{-4}$		DESIG=13
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 $\times 10^{-3}$	90%	DESIG=14
Γ_{15} $4\pi^+ 4\pi^-$	< 8 $\times 10^{-5}$	90%	DESIG=15
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	< 2.1 $\times 10^{-3}$	90%	DESIG=16
Γ_{17} $J/\psi J/\psi$	< 7 $\times 10^{-5}$	90%	DESIG=17
Γ_{18} $J/\psi \psi(2S)$	< 1.2 $\times 10^{-4}$	90%	DESIG=18
Γ_{19} $\psi(2S) \psi(2S)$	< 3.1 $\times 10^{-5}$	90%	DESIG=19
Γ_{20} $J/\psi(1S)$ anything	< 2.3 $\times 10^{-3}$	90%	DESIG=20

 $\chi_{b0}(1P)$ BRANCHING RATIOS

NODE=M076220

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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1.94±0.27 OUR AVERAGE

2.07±0.24±0.21

1,2 LEES

14M

BABR

 $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

1.76±0.30±0.18

87

3,4 KORNICER

11

CLEO

 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

< 4.6

90

5 LEES

11J

BABR

 $\Upsilon(2S) \rightarrow X \gamma$

< 6

90

WALK

86

CBAL

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

< 11

90

PAUSS

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ LEES 14M quotes $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (7.75 \pm 0.91) \times 10^{-4}$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons. Assumes $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M076R1;LINKAGE=A

² LEES 14M reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (7.75 \pm 0.91) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R1;LINKAGE=B

³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

NODE=M076R1;LINKAGE=KA

⁴ KORNICER 11 reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (6.59 \pm 0.96 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R1;LINKAGE=KR

⁵ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$.

NODE=M076R1;LINKAGE=LE

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<10.4 $\times 10^{-2}$

90

6,7 BRIERE

08

CLEO

 $\Upsilon(2S) \rightarrow \gamma D^0 X$ ⁶ For $p_{D^0} > 2.5$ GeV/c.

NODE=M076R01

NODE=M076R01

⁷ The authors also present their result as $(5.6 \pm 3.6 \pm 0.5) \times 10^{-2}$.

NODE=M076R01;LINKAGE=BR

NODE=M076R01;LINKAGE=RI

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<1.6

90

8 ASNER

08A

CLEO

 $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

NODE=M076R02

NODE=M076R02

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{total}$ Γ_4/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 2×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R03
NODE=M076R03

NODE=M076R03;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{total}$ Γ_5/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 18×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R04
NODE=M076R04

NODE=M076R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{total}$ Γ_6/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 8×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R05
NODE=M076R05

NODE=M076R05;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{total}$ Γ_7/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.6±0.1	7	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

¹² ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ = $(4 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R06
NODE=M076R06

NODE=M076R06;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{total}$ Γ_8/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

¹³ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 10×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R07
NODE=M076R07

NODE=M076R07;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{total}$ Γ_9/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

¹⁴ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 20×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R08
NODE=M076R08

NODE=M076R08;LINKAGE=AS

$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{total}$ Γ_{10}/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

¹⁵ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 6×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R09
NODE=M076R09

NODE=M076R09;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^-)/\Gamma_{total}$ Γ_{11}/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

¹⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 3×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R10
NODE=M076R10

NODE=M076R10;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{total}$ Γ_{12}/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

¹⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 22×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R11
NODE=M076R11

NODE=M076R11;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 1.2 \pm 0.2$	9	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-K^+K^-$
<p>¹⁸ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ = $(9 \pm 4 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M076R12
NODE=M076R12

NODE=M076R12;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-K^+K^-\pi^0$
<p>¹⁹ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ < 37×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.</p>				

NODE=M076R13
NODE=M076R13

NODE=M076R13;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	20 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+4\pi^-$
<p>²⁰ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ < 3×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.</p>				

NODE=M076R14
NODE=M076R14

NODE=M076R14;LINKAGE=AS

 $\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21	90	21 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+4\pi^-2\pi^0$
<p>²¹ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ < 77×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.</p>				

NODE=M076R15
NODE=M076R15

NODE=M076R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
<p>²²SHEN 12 reports < 7.1×10^{-5} from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.</p>				

NODE=M076R16
NODE=M076R16

NODE=M076R16;LINKAGE=SH

 $\Gamma(J/\psi\psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	23 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
<p>²³SHEN 12 reports < 12×10^{-5} from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.</p>				

NODE=M076R17
NODE=M076R17

NODE=M076R17;LINKAGE=SH

 $\Gamma(\psi(2S)\psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	24 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
<p>²⁴SHEN 12 reports < 3.1×10^{-5} from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow \psi(2S)\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.</p>				

NODE=M076R18
NODE=M076R18

NODE=M076R18;LINKAGE=SH

 $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.3×10^{-3}	90	JIA	17A BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M076R00
NODE=M076R00 $\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M076230

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{73}^{\Upsilon(2S)}/\Gamma_{\Upsilon(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7×10^{-3}	90	25 LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
<p>²⁵LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6_{-2.6}^{+3.7}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.</p>				

NODE=M076B02
NODE=M076B02

NODE=M076B02;LINKAGE=LE

$B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.67±0.28 OUR AVERAGE

2.9 ^{+1.7} _{-1.4} ^{+0.1} _{-0.8}		26 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
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1.63±0.24±0.15	87	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
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²⁶ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.

NODE=M076B01
NODE=M076B01

NODE=M076B01;LINKAGE=A

 $[B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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3.28±0.37

	27 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
--	---------	----------	--

²⁷ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.

NODE=M076A01
NODE=M076A01

NODE=M076A01;LINKAGE=A

 $\chi_{b0}(1P)$ REFERENCES

JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54313
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)	REFID=22290
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)	REFID=22286

NODE=M076

NODE=M077

 $\chi_{b1}(1P)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 1$ from SKWARNICKI 87.

NODE=M077

 $\chi_{b1}(1P)$ MASS

VALUE (MeV)	DOCUMENT ID
9892.78±0.26±0.31 OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M077M

NODE=M077M
→ UNCHECKED ←

 $m_{\chi_{b1}(1P)} - m_{\Upsilon(1S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
432.10±0.26±0.10	50	¹ AAIJ	24AC LHCB	$\chi_{b1}(1P) \rightarrow \Upsilon(1S) \mu^+ \mu^-$

NODE=M077A00

NODE=M077A00

¹ Observed in prompt $p\bar{p}$ production.

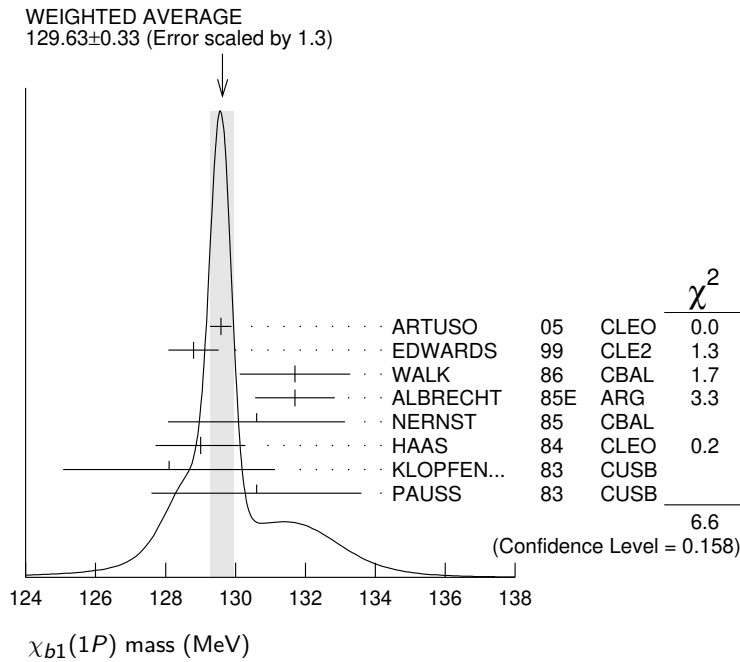
NODE=M077A00;LINKAGE=A

 γ ENERGY IN $\Upsilon(2S)$ DECAY

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
129.63±0.33 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
129.58±0.09±0.29	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
128.8 ±0.4 ±0.6	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
131.7 ±0.9 ±1.3	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
131.7 ±0.3 ±1.1	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
130.6 ±0.8 ±2.4	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
129 ±0.8 ±1	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
128.1 ±0.4 ±3.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ±3.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077DM

NODE=M077DM



$\chi_{b1}(1P)$ DECAY MODES

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $\gamma \Upsilon(1S)$	(35.2 ± 2.0) %		DESIG=1
Γ_2 $D^0 X$	(12.6 ± 2.2) %		DESIG=2
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(2.0 ± 0.6) × 10 ⁻⁴		DESIG=3
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	(1.3 ± 0.5) × 10 ⁻⁴		DESIG=4
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	90%	DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(8.0 ± 2.5) × 10 ⁻⁴		DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.5 ± 0.5) × 10 ⁻⁴		DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5 ± 1.2) × 10 ⁻⁴		DESIG=8
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6 ± 3.2) × 10 ⁻⁴		DESIG=9
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(9.3 ± 3.3) × 10 ⁻⁴		DESIG=10
Γ_{11} $3\pi^+ 3\pi^-$	(1.9 ± 0.6) × 10 ⁻⁴		DESIG=11
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.7 ± 0.5) × 10 ⁻³		DESIG=12
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	(2.6 ± 0.8) × 10 ⁻⁴		DESIG=13
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(7.5 ± 2.6) × 10 ⁻⁴		DESIG=14
Γ_{15} $4\pi^+ 4\pi^-$	(2.6 ± 0.9) × 10 ⁻⁴		DESIG=15
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.4 ± 0.6) × 10 ⁻³		DESIG=16
Γ_{17} ω anything	(4.9 ± 1.4) %		DESIG=21
Γ_{18} ωX_{tetra}	< 4.44 × 10 ⁻⁴	90%	DESIG=22
Γ_{19} $J/\psi J/\psi$	< 2.7 × 10 ⁻⁵	90%	DESIG=17
Γ_{20} $J/\psi \psi(2S)$	< 1.7 × 10 ⁻⁵	90%	DESIG=18
Γ_{21} $\psi(2S) \psi(2S)$	< 6 × 10 ⁻⁵	90%	DESIG=19
Γ_{22} $J/\psi(1S)$ anything	< 1.1 × 10 ⁻³	90%	DESIG=20
Γ_{23} $J/\psi(1S) X_{tetra}$	< 2.27 × 10 ⁻⁴	90%	DESIG=23

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{total}$	Γ_1/Γ	
VALUE	EVTS	DOCUMENT ID TECN COMMENT
0.352 ± 0.020 OUR AVERAGE		
0.356 ^{+0.016} _{-0.022} ± 0.019	964k	¹ FULSOM 18 BELL $\Upsilon(2S) \rightarrow \gamma X$
0.364 ± 0.017 ± 0.019		^{2,3,4} LEES 14M BABR $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
0.331 ± 0.018 ± 0.017	3222	^{4,5} KORNICER 11 CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
0.350 ± 0.023 ± 0.018	13k	⁶ LEES 11J BABR $\Upsilon(2S) \rightarrow X \gamma$
0.34 ± 0.07 ± 0.02	53	^{4,7,8} WALK 86 CBAL $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.47 ± 0.18		KLOPFEN... 83 CUSB $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077R1
NODE=M077R1
OCCUR=4

¹ FULSOM 18 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.45 \pm 0.02^{+0.11}_{-0.15}) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=J

² LEES 14M quotes $\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}} = (2.51 \pm 0.12) \%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M077R1;LINKAGE=B

³ LEES 14M reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.51 \pm 0.12) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=D

⁴ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M077R1;LINKAGE=KA

⁵ KORNICER 11 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=KR

⁶ LEES 11J reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=LE

⁷ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.8 \pm 0.9 \pm 0.7) \%$.

NODE=M077R1;LINKAGE=A

⁸ WALK 86 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (23.4 \pm 3.63 \pm 2.82) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=C

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±1.9±1.1	2310	¹ BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

NODE=M077R01
NODE=M077R01

¹ For $p_{D^0} > 2.5$ GeV/c.

NODE=M077R01;LINKAGE=BR

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.6±0.1	18	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

NODE=M077R02
NODE=M077R02

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (14 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.5±0.1	11	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

NODE=M077R03
NODE=M077R03

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (9 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R03;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

NODE=M077R04
NODE=M077R04

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] < 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±2.4±0.4	46	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

NODE=M077R05
NODE=M077R05

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (55 \pm 9 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R05;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.5±0.5±0.1	18	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(10 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R06
NODE=M077R06

NODE=M077R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5±1.2±0.2	22	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(24 \pm 6 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R07
NODE=M077R07

NODE=M077R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±3.2±0.4	26	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(59 \pm 14 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R08
NODE=M077R08

NODE=M077R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±3.3±0.5	21	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(64 \pm 16 \pm 16) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R09
NODE=M077R09

NODE=M077R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.6±0.1	25	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(13 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R10
NODE=M077R10

NODE=M077R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
17±5±1	56	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(119 \pm 18 \pm 32) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R11
NODE=M077R11

NODE=M077R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6±0.8±0.1	21	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(18 \pm 4 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R12
NODE=M077R12

NODE=M077R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±2.6±0.4	28	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ = $(52 \pm 11 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R13
NODE=M077R13

NODE=M077R13;LINKAGE=AS

$\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6±0.9±0.1	24	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$

NODE=M077R14
NODE=M077R14

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (18 \pm 4 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$
 $(6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

NODE=M077R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
14±5±1	26	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

NODE=M077R15
NODE=M077R15

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (96 \pm 24 \pm 29) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$
 $(6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

NODE=M077R15;LINKAGE=AS

 $\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.9±1.3±0.6	51k	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M077R19
NODE=M077R19 $\Gamma(\omega X_{\text{tetra}})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<44.4 × 10⁻⁵	90	¹ JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M077R23
NODE=M077R23

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the
range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range
from 3.3×10^{-5} to 44.4×10^{-5} .

NODE=M077R23;LINKAGE=A

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

NODE=M077R16
NODE=M077R16

¹ SHEN 12 reports $< 2.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.

NODE=M077R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

NODE=M077R17
NODE=M077R17

¹ SHEN 12 reports $< 1.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times$
 10^{-2} .

NODE=M077R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

NODE=M077R18
NODE=M077R18

¹ SHEN 12 reports $< 6.2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times$
 10^{-2} .

NODE=M077R18;LINKAGE=SH

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.1 × 10⁻³	90	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M077R00
NODE=M077R00 $\Gamma(J/\psi(1S) X_{\text{tetra}})/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<22.7 × 10⁻⁵	90	¹ JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M077R22
NODE=M077R22

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the
range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range
from 1.8×10^{-5} to 22.7×10^{-5} .

NODE=M077R22;LINKAGE=A

 $\chi_{b1}(1P)$ Cross-Particle Branching Ratios

NODE=M077230

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{71}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
24.1±0.6±1.5	13k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M077B03
NODE=M077B03

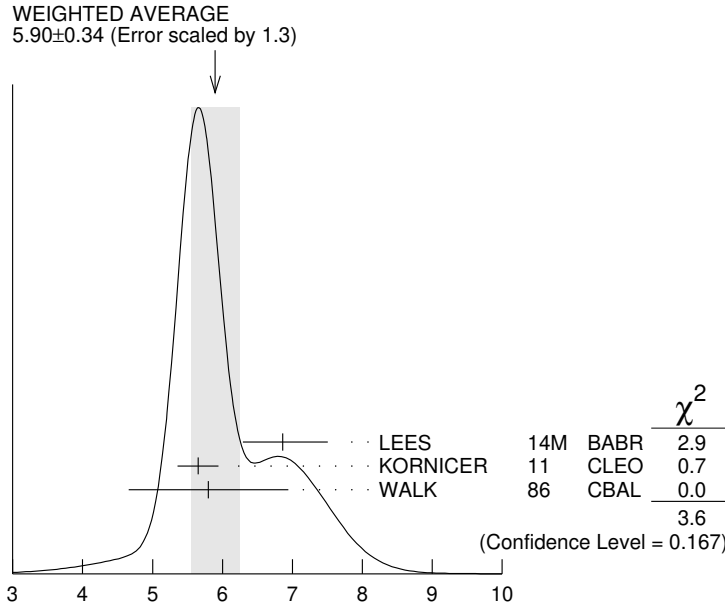
B($\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)$) \times B($\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)$) \times B($\Upsilon(1S) \rightarrow \ell^+ \ell^-$)

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.90\pm0.34 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
6.86 ^{+0.47+0.44} _{-0.45-0.35}		¹ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
5.65 \pm 0.11 \pm 0.27	3222	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
5.8 \pm 0.9 \pm 0.7	53	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.

NODE=M077B01
NODE=M077B01

NODE=M077B01;LINKAGE=A



B($\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)$) \times B($\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)$) \times B($\Upsilon(1S) \rightarrow \ell^+ \ell^-$)
(units 10^{-4})

B($\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)$) \times B($\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P)$) \times B($\Upsilon(1S) \rightarrow \ell^+ \ell^-$)

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.30\pm0.34 OUR AVERAGE				
1.16 ^{+0.78+0.14} _{-0.67-0.16}		¹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
1.33 \pm 0.30 \pm 0.23	50	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.

NODE=M077B02
NODE=M077B02

NODE=M077B02;LINKAGE=A

B($\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X$)/B($\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X$)

VALUE	DOCUMENT ID	TECN	COMMENT
1.068\pm0.010\pm0.040	BRIERE	07 CLEO	$\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R20
NODE=M077R20

B($\chi_{b0}(1P) \rightarrow \rho X + \bar{\rho} X$)/B($\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X$)

VALUE	DOCUMENT ID	TECN	COMMENT
1.11\pm0.15\pm0.20	BRIERE	07 CLEO	$\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R21
NODE=M077R21

$\chi_{b1}(1P)$ REFERENCES

NODE=M077

AAIJ	24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)	REFID=59535
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54313
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51887
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)	REFID=40019
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)	REFID=22290
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)	REFID=22286

$h_b(1P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

NODE=M204

NODE=M204

 $h_b(1P)$ MASS

NODE=M204M

NODE=M204M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9899.3±0.8 OUR AVERAGE				
9899.3±0.4±1.0	112k	TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
9899.1±0.4±1.0	70k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^- \text{ hadrons}$
9902 ±4 ±2	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9898.2 ^{+1.1+1.0} _{-1.0-1.1}	50.0k	¹ ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^- \text{ MM}$
¹ Superseded by MIZUK 12.				

NODE=M204M;LINKAGE=AD

NODE=M204215;NODE=M204

 $h_b(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\eta_b(1S)\gamma$	(52 ⁺⁶ ₋₅) %	
Γ_2 $\Upsilon(1S)\pi^0$	< 1.8 × 10 ⁻³	90%

DESIG=1

DESIG=2

 $h_b(1P)$ BRANCHING RATIOS

NODE=M204225

 $\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$ **Γ_1/Γ** NODE=M204R01
NODE=M204R01

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
52⁺⁶₋₅ OUR AVERAGE				
56 ±8 ±4	33.1k	¹ TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
49.2±5.7 ^{+5.6} _{-3.3}	24k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^- \text{ hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$
¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.				

NODE=M204R01;LINKAGE=A

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ **Γ_2/Γ** NODE=M204R00
NODE=M204R00

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.8 × 10 ⁻³	90	0.43	KOVALENKO	24	BELL $e^+e^- \rightarrow \Upsilon(5S)$

 $h_b(1P)$ REFERENCES

NODE=M204

KOVALENKO	24	PRL 133 261901	E. Kovalenko <i>et al.</i>	(BELLE Collab.)
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
LEES	11k	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)

REFID=63017
REFID=56996
REFID=53962
REFID=54718
REFID=53937

$\chi_{b2}(1P)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 2$ from SKWARNICKI 87.

NODE=M078

NODE=M078

 $\chi_{b2}(1P)$ MASS

NODE=M078M

VALUE (MeV) DOCUMENT ID
9912.21 ± 0.26 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$
 mass = 10023.26 ± 0.31 MeV

NODE=M078M
 → UNCHECKED ←

 $m_{\chi_{b2}(1P)} - m_{\chi_{b1}(1P)}$

NODE=M078DM2

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
19.17 ± 0.20 OUR AVERAGE
 [19.10 ± 0.25 MeV OUR 2024 AVERAGE Scale factor = 1.1]
 19.4 ± 0.4 50 ¹AAIJ 24AC LHCB $\chi_{b(1P)} \rightarrow \Upsilon(1S)\mu^+\mu^-$
 19.81 ± 0.65 ± 0.20 ²AAIJ 14BG LHCB $pp \rightarrow \gamma\mu^+\mu^-X$
 19.01 ± 0.24 LEES 14M BABR $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M078DM2
 NEW

¹Observed in prompt pp production.²From the $\chi_{bj}(1P) \rightarrow \Upsilon(1S)\gamma$ transition.

NODE=M078DM2;LINKAGE=B
 NODE=M078DM2;LINKAGE=A

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M078DM

VALUE (MeV) DOCUMENT ID TECN COMMENT
110.44 ± 0.29 OUR AVERAGE Error includes scale factor of 1.1.
 110.58 ± 0.08 ± 0.30 ARTUSO 05 CLEO $\Upsilon(2S) \rightarrow \gamma X$
 110.8 ± 0.3 ± 0.6 EDWARDS 99 CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
 107.0 ± 1.1 ± 1.3 WALK 86 CBAL $\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
 110.6 ± 0.3 ± 0.9 ALBRECHT 85E ARG $\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
 110.4 ± 0.8 ± 2.2 NERNST 85 CBAL $\Upsilon(2S) \rightarrow \gamma X$
 109.5 ± 0.7 ± 1.0 HAAS 84 CLEO $\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
 108.2 ± 0.3 ± 2.0 KLOPFEN... 83 CUSB $\Upsilon(2S) \rightarrow \gamma X$
 108.8 ± 4.0 PAUSS 83 CUSB $\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M078DM

 $\chi_{b2}(1P)$ DECAY MODES

NODE=M078215;NODE=M078

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $\gamma \Upsilon(1S)$	(18.0 ± 1.0) %		DESIG=1
Γ_2 $D^0 X$	< 7.9 %	90%	DESIG=2
Γ_3 $\pi^+\pi^-K^+K^-\pi^0$	(8 ± 5) × 10 ⁻⁵		DESIG=3
Γ_4 $2\pi^+\pi^-K^-K_S^0$	< 1.0 × 10 ⁻⁴	90%	DESIG=4
Γ_5 $2\pi^+\pi^-K^-K_S^0 2\pi^0$	(5.3 ± 2.4) × 10 ⁻⁴		DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(3.5 ± 1.4) × 10 ⁻⁴		DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.4) × 10 ⁻⁴		DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.1 ± 0.9) × 10 ⁻⁴		DESIG=8
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(3.9 ± 1.8) × 10 ⁻⁴		DESIG=9
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 5 × 10 ⁻⁴	90%	DESIG=10
Γ_{11} $3\pi^+ 3\pi^-$	(7.0 ± 3.1) × 10 ⁻⁵		DESIG=11
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.0 ± 0.4) × 10 ⁻³		DESIG=12
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	< 8 × 10 ⁻⁵	90%	DESIG=13
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(3.6 ± 1.5) × 10 ⁻⁴		DESIG=14
Γ_{15} $4\pi^+ 4\pi^-$	(8 ± 4) × 10 ⁻⁵		DESIG=15
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.8 ± 0.7) × 10 ⁻³		DESIG=16
Γ_{17} $J/\psi J/\psi$	< 4 × 10 ⁻⁵	90%	DESIG=17
Γ_{18} $J/\psi \psi(2S)$	< 5 × 10 ⁻⁵	90%	DESIG=18
Γ_{19} $\psi(2S)\psi(2S)$	< 1.6 × 10 ⁻⁵	90%	DESIG=19
Γ_{20} $J/\psi(1S)$ anything	(1.5 ± 0.4) × 10 ⁻³		DESIG=20

$\chi_{b2}(1P)$ BRANCHING RATIOS

NODE=M078220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.180 ± 0.010 OUR AVERAGE						
$0.164^{+0.009}_{-0.010} \pm 0.008$	503k	¹ FULSOM	18	BELL	$\Upsilon(2S) \rightarrow \gamma X$	
$0.185 \pm 0.008 \pm 0.009$		^{2,3,4} LEES	14M	BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$	
$0.186 \pm 0.011 \pm 0.009$	1770	^{4,5} KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$	
$0.194^{+0.014}_{-0.017} \pm 0.009$	8k	⁶ LEES	11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$	
$0.25 \pm 0.06 \pm 0.01$	35	^{4,7,8} WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	
0.20 ± 0.05		KLOPFEN...	83	CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	

NODE=M078R1
NODE=M078R1

OCCUR=2

¹ FULSOM 18 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.17 \pm 0.01^{+0.06}_{-0.07}) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=H

² LEES 14M quotes $\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}} = (1.32 \pm 0.06)\%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M078R1;LINKAGE=B

³ LEES 14M reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.32 \pm 0.06) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=F

⁴ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M078R1;LINKAGE=KA

⁵ KORNICER 11 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.33 \pm 0.04 \pm 0.07) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=KR

⁶ LEES 11J reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (13.9 \pm 0.5^{+0.9}_{-1.1}) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=LE

⁷ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (4.4 \pm 0.9 \pm 0.5) \%$.

NODE=M078R1;LINKAGE=A

⁸ WALK 86 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (17.7 \pm 3.6 \pm 2.0) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=E

$\Gamma(D^0 X)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$< 7.9 \times 10^{-2}$	90	^{1,2} BRIERE	08	CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$	

NODE=M078R01
NODE=M078R01

¹ For $p_{D^0} > 2.5$ GeV/c.

NODE=M078R01;LINKAGE=BR

² The authors also present their result as $(5.4 \pm 1.9 \pm 0.5) \times 10^{-2}$.

NODE=M078R01;LINKAGE=RI

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT		
0.84 ± 0.50 ± 0.04	8	¹ ASNER	08A	CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$	

NODE=M078R02
NODE=M078R02

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (6 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT		
< 1.0	90	¹ ASNER	08A	CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$	

NODE=M078R03
NODE=M078R03

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] < 7 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

NODE=M078R03;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.3±2.4±0.3	11	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

NODE=M078R04
 NODE=M078R04

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (38 \pm 14 \pm 10) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5±1.4±0.2	19	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

NODE=M078R05
 NODE=M078R05

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (25 \pm 8 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.4±0.1	14	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

NODE=M078R06
 NODE=M078R06

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (8 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.9±0.1	13	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

NODE=M078R07
 NODE=M078R07

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (15 \pm 5 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±1.8±0.2	11	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$

NODE=M078R08
 NODE=M078R08

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (28 \pm 11 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$

NODE=M078R09
 NODE=M078R09

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] < 36 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

NODE=M078R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.31±0.03	9	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$

NODE=M078R10
 NODE=M078R10

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (5 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.2±3.6±0.5	34	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$

NODE=M078R11
 NODE=M078R11

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (73 \pm 16 \pm 20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	1 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
1 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R12
NODE=M078R12

NODE=M078R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 1.5 \pm 0.2$	14	1 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
1 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (26 \pm 8 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R13
NODE=M078R13

NODE=M078R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.40 \pm 0.04$	7	1 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
1 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (6 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R14
NODE=M078R14

NODE=M078R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$18 \pm 7 \pm 1$	29	1 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
1 ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (132 \pm 31 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R15
NODE=M078R15

NODE=M078R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	1 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
1 SHEN 12 reports $< 4.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R16
NODE=M078R16

NODE=M078R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	1 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
1 SHEN 12 reports $< 4.9 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R17
NODE=M078R17

NODE=M078R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	1 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
1 SHEN 12 reports $< 1.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R18
NODE=M078R18

NODE=M078R18;LINKAGE=SH

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.50 \pm 0.34 \pm 0.22$	462	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M078R00
NODE=M078R00 $\chi_{b2}(1P)$ Cross-Particle Branching Ratios

NODE=M078230

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{72}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.9 \pm 0.5^{+0.9}_{-1.1}$	8k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M078B03
NODE=M078B03

$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.38 ± 0.16 OUR AVERAGE

$3.63^{+0.36+0.18}_{-0.34-0.19}$		¹ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$3.29 \pm 0.09 \pm 0.16$	1770	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$4.4 \pm 0.9 \pm 0.5$	35	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.NODE=M078B01
NODE=M078B01

NODE=M078B01;LINKAGE=A

 $[B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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55.6 ± 1.6

	¹ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
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¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ events without converted photons.NODE=M078A00
NODE=M078A00

NODE=M078A00;LINKAGE=A

 $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.8 ± 0.5 OUR AVERAGE

$4.68^{+0.99}_{-0.92} \pm 0.37$		¹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$3.56 \pm 0.40 \pm 0.41$	126	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.NODE=M078B02
NODE=M078B02

NODE=M078B02;LINKAGE=A

 $\chi_{b2}(1P)$ REFERENCES

AAIJ	24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)	REFID=59535
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56199
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54313
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)	REFID=40019
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)	REFID=22290
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)	REFID=22286

NODE=M078

$\eta_b(2S)$

$$J^{PC} = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M200

NODE=M200

NODE=M200M

NODE=M200M

$\eta_b(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$9999.0 \pm 3.5^{+2.8}_{-1.9}$	26k	¹ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$9974.6 \pm 2.3 \pm 2.1$	11 ± 4	^{2,3,4} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.				
² SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.				
³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.				
⁴ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass difference measurement.				

NODE=M200M;LINKAGE=MI

NODE=M200M;LINKAGE=A

NODE=M200M;LINKAGE=DO

NODE=M200M;LINKAGE=NI

$m\Upsilon(2S) - m\eta_b(2S)$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$24.3 \pm 3.5^{+2.8}_{-1.9}$	26k	⁵ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$48.7 \pm 2.3 \pm 2.1$	11 ± 4	^{6,7,8} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
⁵ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass measurement.				
⁶ SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.				
⁷ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.				
⁸ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass measurement.				

NODE=M200DM

NODE=M200DM

NODE=M200DM;LINKAGE=MI

NODE=M200DM;LINKAGE=A

NODE=M200DM;LINKAGE=DO

NODE=M200DM;LINKAGE=NI

$\eta_b(2S)$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons

NODE=M200W

NODE=M200W

$\eta_b(2S)$ DECAY MODES

NODE=M200215;NODE=M200

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	seen

DESIG=1

$\eta_b(2S)$ BRANCHING RATIOS

NODE=M200225

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	26k	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	$9,10$	DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons	

NODE=M200R01

NODE=M200R01

⁹SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6 \Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.

¹⁰Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M200R01;LINKAGE=A

NODE=M200R01;LINKAGE=DO

 $\eta_b(2S)$ REFERENCES

SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M200

REFID=55590
REFID=54288
REFID=54718

NODE=M052

 $\Upsilon(2S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\Upsilon(2S)$ MASS

NODE=M052M

NODE=M052M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.4±0.5	¹ SHAMOV	23	RVUE $e^+e^- \rightarrow$ hadrons
••• We do not use the following data for averages, fits, limits, etc. •••			
10022.7±0.4	² SHAMOV	23	RVUE $e^+e^- \rightarrow$ hadrons
10023.5±0.5	^{3,4} ARTAMONOV	00	MD1 $e^+e^- \rightarrow$ hadrons
10023.6±0.5	^{5,6} BARU	86B	MD1 $e^+e^- \rightarrow$ hadrons
10023.1±0.4	⁷ BARBER	84	ARG $e^+e^- \rightarrow$ hadrons

OCCUR=2

¹ Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.

² Obtained by reanalysing ARGUS and Crystal Ball data (BARBER 84), but not authored by the ARGUS and Crystal Ball collaboration.

³ Reanalysis of BARU 86B using new electron mass (COHEN 87).

⁴ Superseded by SHAMOV 23.

⁵ Reanalysis of ARTAMONOV 84.

⁶ Superseded by ARTAMONOV 00.

⁷ Reanalysed by SHAMOV 23.

NODE=M052M;LINKAGE=A

NODE=M052M;LINKAGE=B

NODE=M052M;LINKAGE=AR

NODE=M052M;LINKAGE=E

NODE=M052M;LINKAGE=C

NODE=M052M;LINKAGE=RZ

NODE=M052M;LINKAGE=D

 $m\Upsilon(2S) - m\Upsilon(1S)$

NODE=M052A00

NODE=M052A00

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
562.81±0.11 OUR AVERAGE				
562.71±0.04±0.20	3.7M	¹ AAIJ	24AC	LHCB $\Upsilon \rightarrow \mu^+\mu^-$
562.85±0.03±0.12	89k	¹ AAIJ	24AC	LHCB $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$

¹ Observed in prompt $p\bar{p}$ production.

OCCUR=2

NODE=M052A00;LINKAGE=A

 $\Upsilon(2S)$ WIDTH

NODE=M052W

NODE=M052W

→ UNCHECKED ←

VALUE (keV)	DOCUMENT ID
31.98±2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

 $\Upsilon(2S)$ DECAY MODES

NODE=M052215;NODE=M052

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\Upsilon(1S)\pi^+\pi^-$	(17.85±0.26) %	
Γ_2 $\Upsilon(1S)\pi^0\pi^0$	(8.6±0.4) %	
Γ_3 $\tau^+\tau^-$	(2.00±0.21) %	
Γ_4 $\mu^+\mu^-$	(1.93±0.17) %	S=2.2
Γ_5 e^+e^-	(1.91±0.16) %	
Γ_6 $\Upsilon(1S)\pi^0$	< 4	$\times 10^{-5}$ CL=90%
Γ_7 $\Upsilon(1S)\eta$	(2.9±0.4) $\times 10^{-4}$	S=2.0
Γ_8 $J/\psi(1S)$ anything	< 6	$\times 10^{-3}$ CL=90%
Γ_9 $J/\psi(1S)\eta_c$	< 5.4	$\times 10^{-6}$ CL=90%
Γ_{10} $J/\psi(1S)\chi_{c0}$	< 3.4	$\times 10^{-6}$ CL=90%
Γ_{11} $J/\psi(1S)\chi_{c1}$	< 1.2	$\times 10^{-6}$ CL=90%

DESIG=4

DESIG=5

DESIG=3

DESIG=1

DESIG=2

DESIG=10

DESIG=6

DESIG=20

DESIG=143

DESIG=144

DESIG=145

Γ ₁₂	$J/\psi(1S)\chi_{c2}$	< 2.0	$\times 10^{-6}$	CL=90%	DESIG=146
Γ ₁₃	$J/\psi(1S)\eta_c(2S)$	< 2.5	$\times 10^{-6}$	CL=90%	DESIG=147
Γ ₁₄	$J/\psi(1S)X(3940)$	< 2.0	$\times 10^{-6}$	CL=90%	DESIG=148
Γ ₁₅	$J/\psi(1S)X(4160)$	< 2.0	$\times 10^{-6}$	CL=90%	DESIG=149
Γ ₁₆	χ_{c1} anything	(2.2 ± 0.5)	$\times 10^{-4}$		DESIG=157
Γ ₁₇	$\chi_{c1}(1P)^0 X_{tetra}$	< 3.67	$\times 10^{-5}$	CL=90%	DESIG=160
Γ ₁₈	χ_{c2} anything	(2.3 ± 0.8)	$\times 10^{-4}$		DESIG=158
Γ ₁₉	$\psi(2S)\eta_c$	< 5.1	$\times 10^{-6}$	CL=90%	DESIG=150
Γ ₂₀	$\psi(2S)\chi_{c0}$	< 4.7	$\times 10^{-6}$	CL=90%	DESIG=151
Γ ₂₁	$\psi(2S)\chi_{c1}$	< 2.5	$\times 10^{-6}$	CL=90%	DESIG=152
Γ ₂₂	$\psi(2S)\chi_{c2}$	< 1.9	$\times 10^{-6}$	CL=90%	DESIG=153
Γ ₂₃	$\psi(2S)\eta_c(2S)$	< 3.3	$\times 10^{-6}$	CL=90%	DESIG=154
Γ ₂₄	$\psi(2S)X(3940)$	< 3.9	$\times 10^{-6}$	CL=90%	DESIG=155
Γ ₂₅	$\psi(2S)X(4160)$	< 3.9	$\times 10^{-6}$	CL=90%	DESIG=156
Γ ₂₆	$T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-$	< 1.0	$\times 10^{-6}$	CL=90%	DESIG=162
Γ ₂₇	$T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-$	< 1.67	$\times 10^{-5}$	CL=90%	DESIG=163
Γ ₂₈	$T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp$	< 7.3	$\times 10^{-6}$	CL=90%	DESIG=164
Γ ₂₉	$T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-$	< 1.35	$\times 10^{-5}$	CL=90%	DESIG=165
Γ ₃₀	$T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-$	< 2.67	$\times 10^{-5}$	CL=90%	DESIG=166
Γ ₃₁	$T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp$	< 2.72	$\times 10^{-5}$	CL=90%	DESIG=167
Γ ₃₂	$T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-$	< 2.03	$\times 10^{-5}$	CL=90%	DESIG=168
Γ ₃₃	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp$	< 1.11	$\times 10^{-5}$	CL=90%	DESIG=170
Γ ₃₄	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp$	< 2.11	$\times 10^{-5}$	CL=90%	DESIG=171
Γ ₃₅	$^2\bar{H}$ anything	$(2.78^{+0.30}_{-0.26})$	$\times 10^{-5}$	S=1.2	DESIG=16
Γ ₃₆	hadrons	(94 ± 11)	%		DESIG=101
Γ ₃₇	ggg	(58.8 ± 1.2)	%		DESIG=105
Γ ₃₈	γgg	(1.87 ± 0.28)	%		DESIG=106
Γ ₃₉	$\phi K^+ K^-$	(1.6 ± 0.4)	$\times 10^{-6}$		DESIG=133
Γ ₄₀	$\omega \pi^+ \pi^-$	< 2.58	$\times 10^{-6}$	CL=90%	DESIG=134
Γ ₄₁	$K^*(892)^0 K^- \pi^+ + c.c.$	(2.3 ± 0.7)	$\times 10^{-6}$		DESIG=135
Γ ₄₂	$\phi f'_2(1525)$	< 1.33	$\times 10^{-6}$	CL=90%	DESIG=136
Γ ₄₃	$\omega f_2(1270)$	< 5.7	$\times 10^{-7}$	CL=90%	DESIG=137
Γ ₄₄	$\rho(770) a_2(1320)$	< 8.8	$\times 10^{-7}$	CL=90%	DESIG=138
Γ ₄₅	$K^*(892)^0 K_2^*(1430)^0 + c.c.$	(1.5 ± 0.6)	$\times 10^{-6}$		DESIG=139
Γ ₄₆	$K_1(1270)^\pm K^\mp$	< 3.22	$\times 10^{-6}$	CL=90%	DESIG=140
Γ ₄₇	$K_1(1400)^\pm K^\mp$	< 8.3	$\times 10^{-7}$	CL=90%	DESIG=141
Γ ₄₈	$b_1(1235)^\pm \pi^\mp$	< 4.0	$\times 10^{-7}$	CL=90%	DESIG=142
Γ ₄₉	$\rho \pi$	< 1.16	$\times 10^{-6}$	CL=90%	DESIG=126
Γ ₅₀	$\pi^+ \pi^- \pi^0$	< 8.0	$\times 10^{-7}$	CL=90%	DESIG=127
Γ ₅₁	$\omega \pi^0$	< 1.63	$\times 10^{-6}$	CL=90%	DESIG=128
Γ ₅₂	$\pi^+ \pi^- \pi^0 \pi^0$	(1.30 ± 0.28)	$\times 10^{-5}$		DESIG=129
Γ ₅₃	$K_S^0 K^+ \pi^- + c.c.$	(1.14 ± 0.33)	$\times 10^{-6}$		DESIG=130
Γ ₅₄	$K^*(892)^0 \bar{K}^0 + c.c.$	< 4.22	$\times 10^{-6}$	CL=90%	DESIG=131
Γ ₅₅	$K^*(892)^- K^+ + c.c.$	< 1.45	$\times 10^{-6}$	CL=90%	DESIG=132
Γ ₅₆	$f_1(1285)$ anything	(2.2 ± 1.6)	$\times 10^{-3}$		DESIG=159
Γ ₅₇	$f_1(1285) X_{tetra}$	< 6.47	$\times 10^{-5}$	CL=90%	DESIG=161
Γ ₅₈	$D_s^+ D_{s1}(2536)^-$				DESIG=177
Γ ₅₉	$D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0$	(1.6 ± 0.4)	$\times 10^{-5}$		DESIG=178
Γ ₆₀	$D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-$	(8.4 ± 2.3)	$\times 10^{-6}$		DESIG=179
Γ ₆₁	$D_s^{*+} D_{s1}(2536)^-$				DESIG=180
Γ ₆₂	$D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0$	(1.4 ± 0.4)	$\times 10^{-5}$		DESIG=181
Γ ₆₃	$D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-$	(8.2 ± 3.1)	$\times 10^{-6}$		DESIG=182

Γ_{64}	$D_s^+ D_{s2}^{*+}(2573)^-$				DESIG=183
Γ_{65}	$D_s^+ D_{s2}^{*+}(2573)^-, D_{s2}^{*-} \rightarrow$	$(1.4 \pm 0.4) \times 10^{-5}$			DESIG=184
Γ_{66}	$D_s^+ D_{s2}^{*+}(2573)^-, D_{s2}^{*-} \rightarrow$	$(6.9 \pm 3.0) \times 10^{-6}$			DESIG=185
	$K^- D^0$				
	$K_S^0 D^-$				
Γ_{67}	$D_s^{*+} D_{s2}^{*+}(2573)^-$				DESIG=186
Γ_{68}	$D_s^{*+} D_{s2}^{*+}(2573)^-, D_{s2}^{*-} \rightarrow$	$(9 \pm 5) \times 10^{-6}$			DESIG=187
	$K^- D^0$				
Γ_{69}	$D_s^{*+} D_{s2}^{*+}(2573)^-, D_{s2}^{*-} \rightarrow$	$(5 \pm 6) \times 10^{-6}$			DESIG=188
	$K_S^0 D^-$				
Γ_{70}	Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$			DESIG=121
Radiative decays					
Γ_{71}	$\gamma \chi_{b1}(1P)$	$(6.9 \pm 0.4) \%$			NODE=M052;CLUMP=A DESIG=8
Γ_{72}	$\gamma \chi_{b2}(1P)$	$(7.15 \pm 0.35) \%$			DESIG=7
Γ_{73}	$\gamma \chi_{b0}(1P)$	$(3.8 \pm 0.4) \%$			DESIG=9
Γ_{74}	$\gamma f_0(1710)$	$< 5.9 \times 10^{-4}$	CL=90%		DESIG=13
Γ_{75}	$\gamma f_2'(1525)$	$< 5.3 \times 10^{-4}$	CL=90%		DESIG=12
Γ_{76}	$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	CL=90%		DESIG=11
Γ_{77}	$\gamma f_J(2220)$				DESIG=14
Γ_{78}	$\gamma \eta_c(1S)$	$< 2.7 \times 10^{-5}$	CL=90%		DESIG=111
Γ_{79}	$\gamma \chi_{c0}$	$< 1.0 \times 10^{-4}$	CL=90%		DESIG=112
Γ_{80}	$\gamma \chi_{c1}$	$< 3.6 \times 10^{-6}$	CL=90%		DESIG=113
Γ_{81}	$\gamma \chi_{c2}$	$< 1.5 \times 10^{-5}$	CL=90%		DESIG=114
Γ_{82}	$\gamma \chi_{c1}(3872)$	$< 1.8 \times 10^{-5}$	CL=90%		DESIG=172
Γ_{83}	$\gamma \chi_{c1}(3872), \chi_{c1} \rightarrow$	$< 2.4 \times 10^{-6}$	CL=90%		DESIG=116
	$\pi^+ \pi^- \pi^0 J/\psi$				
Γ_{84}	$\gamma \chi_{c0}(3915) \rightarrow \omega J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%		DESIG=117
Γ_{85}	$\gamma \chi_{c1}(4140) \rightarrow \phi J/\psi$	$< 1.2 \times 10^{-6}$	CL=90%		DESIG=118
Γ_{86}	$\gamma X(4350) \rightarrow \phi J/\psi$	$< 1.3 \times 10^{-6}$	CL=90%		DESIG=119
Γ_{87}	$\gamma \eta_b(1S)$	$(5.5 \pm_{-0.9}^{1.1}) \times 10^{-4}$	S=1.2		DESIG=102
Γ_{88}	$\gamma \eta_b(1S) \rightarrow \gamma$ Sum of 26 exclu- sive modes	$< 3.7 \times 10^{-6}$	CL=90%		DESIG=124
Γ_{89}	$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	$< 4.9 \times 10^{-6}$	CL=90%		DESIG=125
Γ_{90}	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] $< 1.95 \times 10^{-4}$	CL=95%		DESIG=103
Γ_{91}	$\gamma A^0 \rightarrow \gamma$ hadrons	$< 8 \times 10^{-5}$	CL=90%		DESIG=108
Γ_{92}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$< 8.3 \times 10^{-6}$	CL=90%		DESIG=123
Lepton Family number (LF) violating modes					
Γ_{93}	$e^\pm \tau^\mp$	LF $< 1.12 \times 10^{-6}$	CL=90%		NODE=M052;CLUMP=B DESIG=107
Γ_{94}	$\mu^\pm \tau^\mp$	LF $< 2.3 \times 10^{-7}$	CL=90%		DESIG=104

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C52

FIT INFORMATION

An overall fit to 3 branching ratios uses 13 measurements to determine 2 parameters. The overall fit has a $\chi^2 = 11.8$ for 11 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

$$x_7 \begin{array}{|c} \hline 2 \\ \hline x_1 \end{array}$$

$\Upsilon(2S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M052218

$$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

 $\Gamma_4\Gamma_5/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
6.5±1.5±1.0	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M052G1
NODE=M052G1

$$\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

 $\Gamma_1\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
105.4±1.0±4.2	11.8k	¹ AUBERT	08BP BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

NODE=M052G03
NODE=M052G03

¹Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052G03;LINKAGE=AU

$$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

 $\Gamma_{36}\Gamma_5/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.577±0.009 OUR AVERAGE			

NODE=M052G2
NODE=M052G2

0.581±0.004±0.009	¹ ROSNER	06	CLEO	10.0 $e^+e^- \rightarrow \text{hadrons}$
0.552±0.031±0.017	¹ BARU	96	MD1	$e^+e^- \rightarrow \text{hadrons}$
0.54 ±0.04 ±0.02	¹ JAKUBOWSKI	88	CBAL	$e^+e^- \rightarrow \text{hadrons}$
0.58 ±0.03 ±0.04	² GILES	84B	CLEO	$e^+e^- \rightarrow \text{hadrons}$
0.60 ±0.12 ±0.07	² ALBRECHT	82	DASP	$e^+e^- \rightarrow \text{hadrons}$
0.54 ±0.07 ^{+0.09} _{-0.05}	² NICZYPORUK	81C	LENA	$e^+e^- \rightarrow \text{hadrons}$
0.41 ±0.18	² BOCK	80	CNTR	$e^+e^- \rightarrow \text{hadrons}$

¹Radiative corrections evaluated following KURAEV 85.

²Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M052G2;LINKAGE=P
NODE=M052G2;LINKAGE=R $\Upsilon(2S)$ PARTIAL WIDTHS

NODE=M052220

$$\Gamma(e^+e^-)$$

 Γ_5

VALUE (keV)	DOCUMENT ID
0.612±0.011 OUR EVALUATION	

NODE=M052W2
NODE=M052W2
→ UNCHECKED ← $\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

$$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

 Γ_1/Γ

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
17.85±0.26 OUR FIT				
17.92±0.26 OUR AVERAGE				

NODE=M052R4
NODE=M052R4
NODE=M052R4

16.8 ±1.1 ±1.3	906k	¹ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
17.80±0.05±0.37	170k	² LEES	11L BABR	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
18.02±0.02±0.61	851k	³ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^-MM$
17.22±0.17±0.75	11.8k	⁴ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
19.2 ±0.2 ±1.0	52.6k	⁵ ALEXANDER	98 CLE2	$\pi^+\pi^-\ell^+\ell^-, \pi^+\pi^-MM$
18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87 ARG	$e^+e^- \rightarrow \pi^+\pi^-MM$
16.9 ±4.0		GELPHMAN	85 CBAL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
19.1 ±1.2 ±0.6		BESSON	84 CLEO	$\pi^+\pi^-MM$
18.9 ±2.6		FONSECA	84 CUSB	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$
21 ±7	7	NICZYPORUK	81B LENA	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$

¹LEES 11c reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything})] = (1.78 \pm 0.02 \pm 0.11) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything}) = (10.6 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³A weighted average of the inclusive and exclusive results.

⁴Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$ and, $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

⁵Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R4;LINKAGE=ES

NODE=M052R4;LINKAGE=LE
NODE=M052R4;LINKAGE=BH
NODE=M052R4;LINKAGE=AU

NODE=M052R4;LINKAGE=T

$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{total}$

Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6 ± 0.4 OUR AVERAGE				
8.43 ± 0.16 ± 0.42	38k	¹ BHARI	09	CLEO $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 ± 0.6 ± 0.8	275	² ALEXANDER	98	CLE2 $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 ± 1.9 ± 1.9	25	ALBRECHT	87	ARG $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 ± 1.5		GELPHMAN	85	CBAL $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 ± 2.3		FONSECA	84	CUSB $e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

NODE=M052R5
NODE=M052R5

¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R5;LINKAGE=BH
NODE=M052R5;LINKAGE=T

$\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.462 ± 0.037	¹ BHARI	09	CLEO $e^+e^- \rightarrow \Upsilon(2S)$
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¹ Not independent of other values reported by BHARI 09.

NODE=M052R21
NODE=M052R21

NODE=M052R21;LINKAGE=BH

$\Gamma(\tau^+\tau^-)/\Gamma_{total}$

Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.00 ± 0.21 OUR AVERAGE

2.00 ± 0.12 ± 0.18	22k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S) \rightarrow \tau^+\tau^-$
1.7 ± 1.5 ± 0.6		HAAS	84B	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

¹ BESSON 07 reports $[\Gamma(\Upsilon(2S) \rightarrow \tau^+\tau^-)/\Gamma_{total}] / [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = 1.04 \pm 0.04 \pm 0.05$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M052R3
NODE=M052R3

NODE=M052R3;LINKAGE=BE

$\Gamma(\mu^+\mu^-)/\Gamma_{total}$

Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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0.0193 ± 0.0017 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

0.0203 ± 0.0003 ± 0.0008	120k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0122 ± 0.0028 ± 0.0019		¹ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
0.0138 ± 0.0025 ± 0.0015		KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
0.009 ± 0.006 ± 0.006		² ALBRECHT	85	ARG $e^+e^- \rightarrow \mu^+\mu^-$
0.018 ± 0.008 ± 0.005		HAAS	84B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

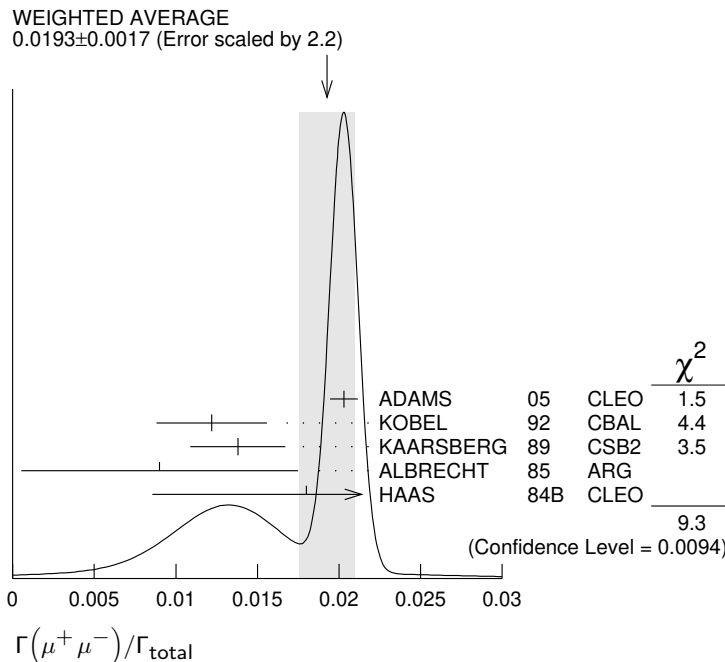
< 0.038	90	NICZYPORUK	81C	LENA $e^+e^- \rightarrow \mu^+\mu^-$
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¹ Taking into account interference between the resonance and continuum.

² Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.

NODE=M052R1
NODE=M052R1

NODE=M052R1;LINKAGE=A
NODE=M052R1;LINKAGE=R



$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_3/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.04±0.04±0.05	22k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$

NODE=M052R17
 NODE=M052R17

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M052R10
 NODE=M052R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4	90	¹ TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0$
< 18	90	² HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<110	90	ALEXANDER	98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
<800	90	LURZ	87	CBAL	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] < 2.3 \times 10^{-4}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.

NODE=M052R10;LINKAGE=TA

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_6/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R09
 NODE=M052R09

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M052R6
 NODE=M052R6

2.9 ±0.4 OUR FIT Error includes scale factor of 2.0.

2.9 ±0.4 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

2.39±0.31±0.14	112	¹ LEES	11L	BABR	$\Upsilon(2S) \rightarrow \ell^+\ell^-\eta$
2.1 $\begin{smallmatrix} +0.7 \\ -0.6 \end{smallmatrix}$ ±0.3	14	² HE	08A	CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

• • • We use the following data for averages but not for fits. • • •

3.55±0.32±0.05	241	³ TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\eta$
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NOTFITTED

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 9	90	^{1,4} AUBERT	08BP	BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$
< 28	90	ALEXANDER	98	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\eta$
< 50	90	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-MM$
< 70	90	LURZ	87	CBAL	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, 3\pi^0)$
< 100	90	BESSON	84	CLEO	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-MM$
< 20	90	FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052R6;LINKAGE=AU

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

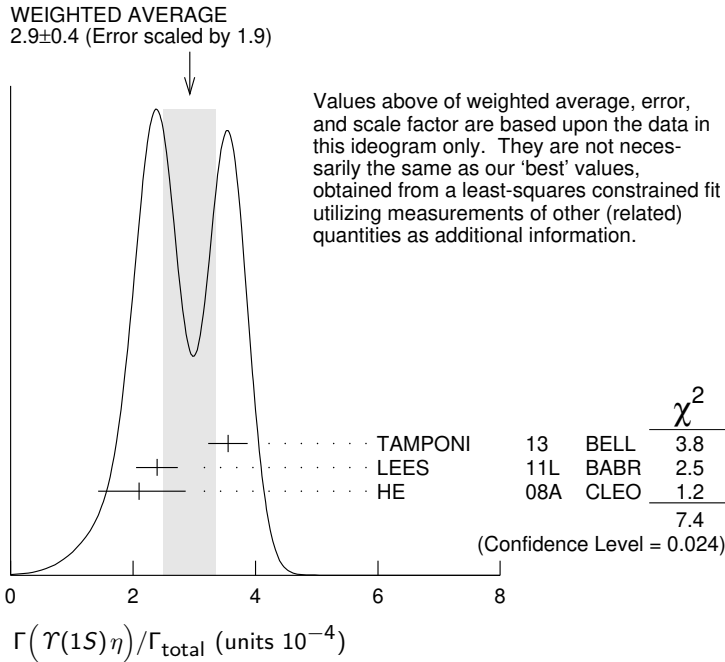
NODE=M052R6;LINKAGE=HE

³ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\eta)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] = (1.99 \pm 0.14 \pm 0.11) \times 10^{-3}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (17.85 \pm 0.26) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M052R6;LINKAGE=TA

⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

NODE=M052R6;LINKAGE=UB



$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_7/Γ_1

NODE=M052R22
NODE=M052R22

VALUE (units 10^{-3}) CL% EVTS DOCUMENT ID TECN COMMENT

1.64±0.25 OUR FIT Error includes scale factor of 2.0.

1.99±0.14±0.11 241 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.35±0.17±0.08 ¹ LEES 11L BABR $\Upsilon(2S) \rightarrow (\pi^+\pi^-(\gamma\gamma))\mu^+\mu^-$

< 5.2 90 ² AUBERT 08BP BABR $e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

¹ Not independent of other values reported by LEES 11L.

² Not independent of other values reported by AUBERT 08BP.

NODE=M052R22;LINKAGE=LE
NODE=M052R22;LINKAGE=AU

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\eta)$

Γ_6/Γ_7

NODE=M052R23
NODE=M052R23

VALUE CL% DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.13 90 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_8/Γ

NODE=M052R16
NODE=M052R16

VALUE CL% DOCUMENT ID TECN COMMENT

<0.006 90 MASCHMANN 90 CBAL $e^+e^- \rightarrow \text{hadrons}$

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$

Γ_9/Γ

NODE=M052R53
NODE=M052R53

VALUE CL% DOCUMENT ID TECN COMMENT

<5.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$

Γ_{10}/Γ

NODE=M052R54
NODE=M052R54

VALUE CL% DOCUMENT ID TECN COMMENT

<3.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$

Γ_{11}/Γ

NODE=M052R55
NODE=M052R55

VALUE CL% DOCUMENT ID TECN COMMENT

<1.2 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$

Γ_{12}/Γ

NODE=M052R56
NODE=M052R56

VALUE CL% DOCUMENT ID TECN COMMENT

<2.0 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$

Γ_{13}/Γ

NODE=M052R57
NODE=M052R57

VALUE CL% DOCUMENT ID TECN COMMENT

<2.5 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$

Γ_{14}/Γ

NODE=M052R58
NODE=M052R58

VALUE CL% DOCUMENT ID TECN COMMENT

<2.0 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$					Γ_{15}/Γ	NODE=M052R59 NODE=M052R59
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<2.0 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$					Γ_{16}/Γ	NODE=M052R00 NODE=M052R00
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$2.24 \pm 0.44 \pm 0.20$	376	JIA	17	BELL	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$	
$\Gamma(\chi_{c1}(1P)^0 X_{\text{tetra}})/\Gamma_{\text{total}}$					Γ_{17}/Γ	NODE=M052R69 NODE=M052R69
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<36.7 \times 10^{-6}$	90	¹ JIA	17A	BELL	$e^+e^- \rightarrow \text{hadrons}$	
¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.4×10^{-6} to 36.7×10^{-6} .						NODE=M052R69;LINKAGE=A
$\Gamma(\chi_{c2} \text{ anything})/\Gamma_{\text{total}}$					Γ_{18}/Γ	NODE=M052R67 NODE=M052R67
<u>VALUE (units 10^{-4})</u>		<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$2.28 \pm 0.73 \pm 0.34$		JIA	17	BELL	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$	
$\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$					Γ_{19}/Γ	NODE=M052R60 NODE=M052R60
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<5.1 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$					Γ_{20}/Γ	NODE=M052R61 NODE=M052R61
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<4.7 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$					Γ_{21}/Γ	NODE=M052R62 NODE=M052R62
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<2.5 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$					Γ_{22}/Γ	NODE=M052R63 NODE=M052R63
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<1.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$					Γ_{23}/Γ	NODE=M052R64 NODE=M052R64
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<3.3 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$					Γ_{24}/Γ	NODE=M052R65 NODE=M052R65
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$					Γ_{25}/Γ	NODE=M052R66 NODE=M052R66
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<3.9 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$	
$\Gamma(T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-)/\Gamma_{\text{total}}$					Γ_{26}/Γ	NODE=M052R71 NODE=M052R71
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<1.0 \times 10^{-6}$	90	¹ JIA	18	BELL	$\Upsilon(2S) \rightarrow J/\psi \pi^\pm X$	
¹ Assuming $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm) = 1$.						NODE=M052R71;LINKAGE=A
$\Gamma(T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-)/\Gamma_{\text{total}}$					Γ_{27}/Γ	NODE=M052R72 NODE=M052R72
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<16.7 \times 10^{-6}$	90	¹ JIA	18	BELL	$\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$	
¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1$						NODE=M052R72;LINKAGE=A
$\Gamma(T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp)/\Gamma_{\text{total}}$					Γ_{28}/Γ	NODE=M052R73 NODE=M052R73
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
$<7.3 \times 10^{-6}$	90	¹ JIA	18	BELL	$\Upsilon(2S) \rightarrow J/\psi \pi^\pm X$	
¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1 = B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm)$.						NODE=M052R73;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<13.5 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm)$

NODE=M052R74
NODE=M052R74

NODE=M052R74;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<26.7 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M052R75
NODE=M052R75

NODE=M052R75;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<27.2 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1 = B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm)$

NODE=M052R76
NODE=M052R76

NODE=M052R76;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<20.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2P)\pi^\pm) = 1$

NODE=M052R77
NODE=M052R77

NODE=M052R77;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<11.1 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M052R79
NODE=M052R79

NODE=M052R79;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<21.1 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S)\pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1 = B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2S)\pi^\pm)$

NODE=M052R80
NODE=M052R80

NODE=M052R80;LINKAGE=A

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.78^{+0.30}_{-0.26}$				OUR AVERAGE Error includes scale factor of 1.2.

NODE=M052R18
NODE=M052R182.64 ± 0.11^{+0.26}_{-0.21} LEES 14G BABR $e^+ e^- \rightarrow \overline{2H} X$ 3.37 ± 0.50 ± 0.25 58 ASNER 07 CLEO $e^+ e^- \rightarrow \overline{2H} X$ $\Gamma(gg)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
58.8 ± 1.2	6M	¹ BESSON	06A	CLEO $\Upsilon(2S) \rightarrow \text{hadrons}$

NODE=M052R01
NODE=M052R01

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(gg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ from BESSON 06A and PDG 08 values of $B(\pi^+ \pi^- \Upsilon(1S)) = (18.1 \pm 0.4)\%$, $B(\pi^0 \pi^0 \Upsilon(1S)) = (8.6 \pm 0.4)\%$, $B(\mu^+ \mu^-) = (1.93 \pm 0.17)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(gg)$ Γ_{38}/Γ_{37}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.18 \pm 0.04 \pm 0.47$	6M	BESSON	06A	CLEO $\Upsilon(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M052R03
NODE=M052R03 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.58 \pm 0.33 \pm 0.18$	58	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^+ K^-)$

NODE=M052R43
NODE=M052R43 $\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.58	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-)\pi^0$

NODE=M052R44
NODE=M052R44 $\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.32 \pm 0.40 \pm 0.54$	135	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M052R45
NODE=M052R45

$\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$					Γ_{42}/Γ	NODE=M052R46 NODE=M052R46
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1.33	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(K^+ K^-)$		
$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$					Γ_{43}/Γ	NODE=M052R47 NODE=M052R47
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<0.57	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$		
$\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}}$					Γ_{44}/Γ	NODE=M052R48 NODE=M052R48
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<0.88	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$		
$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{45}/Γ	NODE=M052R49 NODE=M052R49
<u>VALUE (units 10⁻⁶)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
1.53±0.52±0.19	32	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$		
$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$					Γ_{46}/Γ	NODE=M052R50 NODE=M052R50
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<3.22	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$		
$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$					Γ_{47}/Γ	NODE=M052R51 NODE=M052R51
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<0.83	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$		
$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$					Γ_{48}/Γ	NODE=M052R52 NODE=M052R52
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<0.40	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$		
$\Gamma(\rho\pi)/\Gamma_{\text{total}}$					Γ_{49}/Γ	NODE=M052R27 NODE=M052R27
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1.16	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$		
$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{50}/Γ	NODE=M052R28 NODE=M052R28
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<0.80	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$		
$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$					Γ_{51}/Γ	NODE=M052R29 NODE=M052R29
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1.63	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$		
$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$					Γ_{52}/Γ	NODE=M052R30 NODE=M052R30
<u>VALUE (units 10⁻⁶)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
13.0±1.9±2.1	261 ± 37	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$		
$\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{53}/Γ	NODE=M052R40 NODE=M052R40
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1.14±0.30±0.13	40 ± 10	SHEN	13 BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<3.2	90	¹ DOBBS	12A	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$		
¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.						
$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{54}/Γ	NODE=M052R41 NODE=M052R41
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<4.22	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$		
$\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{55}/Γ	NODE=M052R42 NODE=M052R42
<u>VALUE (units 10⁻⁶)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
<1.45	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$		
$\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}}$					Γ_{56}/Γ	NODE=M052R68 NODE=M052R68
<u>VALUE (units 10⁻³)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
2.20±1.50±0.63	2.9k	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$		

$\Gamma(f_1(1285)X_{tetra})/\Gamma_{total}$ Γ_{57}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<64.7 \times 10^{-6}$	90	¹ JIA	17A	BELL $e^+e^- \rightarrow$ hadrons

NODE=M052R70
NODE=M052R70

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 7.8×10^{-6} to 64.7×10^{-6} .

NODE=M052R70;LINKAGE=A

 $\Gamma(D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0)/\Gamma_{total}$ Γ_{59}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.6 \pm 0.3 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R86
NODE=M052R86

 $\Gamma(D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-)/\Gamma_{total}$ Γ_{60}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.18 \pm 0.15$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R87
NODE=M052R87

 $\Gamma(D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0)/\Gamma_{total}$ Γ_{62}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.4 \pm 0.4 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R88
NODE=M052R88

 $\Gamma(D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-)/\Gamma_{total}$ Γ_{63}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.25 \pm 0.19$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R89
NODE=M052R89

 $\Gamma(D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0)/\Gamma_{total}$ Γ_{65}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.4 \pm 0.4 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R90
NODE=M052R90

 $\Gamma(D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-)/\Gamma_{total}$ Γ_{66}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.69 \pm 0.20 \pm 0.22$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R91
NODE=M052R91

 $\Gamma(D_s^{*+} D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0)/\Gamma_{total}$ Γ_{68}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.9 \pm 0.5 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R92
NODE=M052R92

 $\Gamma(D_s^{*+} D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-)/\Gamma_{total}$ Γ_{69}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.54 \pm 0.31 \pm 0.47$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R93
NODE=M052R93

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{total}$ Γ_{70}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	COMMENT
0.29 ± 0.03	^{1,2} DOBBS	12A $\Upsilon(2S) \rightarrow$ hadrons

NODE=M052R08
NODE=M052R08

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

NODE=M052R08;LINKAGE=DO

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R08;LINKAGE=NC

 $\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{total}$ Γ_{71}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.069 ± 0.004	OUR AVERAGE			
$0.0693 \pm 0.0012 \pm 0.0041$	407k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
$0.069 \pm 0.005 \pm 0.009$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
$0.091 \pm 0.018 \pm 0.022$		ALBRECHT	85E	ARG $e^+e^- \rightarrow \gamma\text{conv. } X$
$0.065 \pm 0.007 \pm 0.012$		NERNST	85	CBAL $e^+e^- \rightarrow \gamma X$
$0.080 \pm 0.017 \pm 0.016$		HAAS	84	CLEO $e^+e^- \rightarrow \gamma\text{conv. } X$
0.059 ± 0.014		KLOPFEN...	83	CUSB $e^+e^- \rightarrow \gamma X$

NODE=M052R8
NODE=M052R8

 $\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{total}$ Γ_{72}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0715 ± 0.0035	OUR AVERAGE			
$0.0724 \pm 0.0011 \pm 0.0040$	410k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
$0.074 \pm 0.005 \pm 0.008$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
$0.098 \pm 0.021 \pm 0.024$		ALBRECHT	85E	ARG $e^+e^- \rightarrow \gamma\text{conv. } X$
$0.058 \pm 0.007 \pm 0.010$		NERNST	85	CBAL $e^+e^- \rightarrow \gamma X$
$0.102 \pm 0.018 \pm 0.021$		HAAS	84	CLEO $e^+e^- \rightarrow \gamma\text{conv. } X$
0.061 ± 0.014		KLOPFEN...	83	CUSB $e^+e^- \rightarrow \gamma X$

NODE=M052R7
NODE=M052R7

$\Gamma(\gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.038 ± 0.004 OUR AVERAGE				
0.0375 ± 0.0012 ± 0.0047	198k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.034 ± 0.005 ± 0.006		EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
0.064 ± 0.014 ± 0.016		ALBRECHT	85E ARG	$e^+e^- \rightarrow \gamma\text{conv. } X$
0.036 ± 0.008 ± 0.009		NERNST	85 CBAL	$e^+e^- \rightarrow \gamma X$
0.044 ± 0.023 ± 0.009		HAAS	84 CLEO	$e^+e^- \rightarrow \gamma\text{conv. } X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.035 ± 0.014		KLOPFEN...	83 CUSB	$e^+e^- \rightarrow \gamma X$
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NODE=M052R9
NODE=M052R9

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<59	90	¹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5.9	90	² ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$
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¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.

² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.

NODE=M052R13
NODE=M052R13

OCCUR=2

NODE=M052R13;LINKAGE=M
NODE=M052R13;LINKAGE=N

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<53	90	¹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.

NODE=M052R12
NODE=M052R12

NODE=M052R12;LINKAGE=L

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24.1	90	¹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.

NODE=M052R11
NODE=M052R11

NODE=M052R11;LINKAGE=K

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.8	90	¹ ALBRECHT	89 ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

¹ Includes unknown branching ratio of $f_J(2220) \rightarrow K^+ K^-$.

NODE=M052R14
NODE=M052R14

NODE=M052R14;LINKAGE=S

 $\Gamma(\gamma \eta_c(1S))/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.7 × 10⁻⁵	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R31
NODE=M052R31

 $\Gamma(\gamma \chi_{c0})/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0 × 10⁻⁴	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R32
NODE=M052R32

 $\Gamma(\gamma \chi_{c1})/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.6 × 10⁻⁶	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R33
NODE=M052R33

 $\Gamma(\gamma \chi_{c2})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.5 × 10⁻⁵	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R34
NODE=M052R34

 $\Gamma(\gamma \chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.8 × 10⁻⁵ (CL = 90%)		[<2.3 × 10 ⁻⁵ (CL = 90%) OUR 2024 BEST LIMIT]		
<1.8 × 10⁻⁵	90	¹ WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

¹ WANG 11B reports $[\Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S))] < 0.8 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) = 4.3 \times 10^{-2}$.

NODE=M052R81
NODE=M052R81

NODE=M052R81;LINKAGE=A

 $\Gamma(\gamma \chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+ \pi^- \pi^0 J/\psi)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻⁶	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R36
NODE=M052R36

$\Gamma(\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R37
NODE=M052R37

 $\Gamma(\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R38
NODE=M052R38

 $\Gamma(\gamma X(4350) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-6}$	90	WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R39
NODE=M052R39

 $\Gamma(\gamma\eta_b(1S))/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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$5.5^{+1.1}_{-0.9}$ OUR AVERAGE Error includes scale factor of 1.2.

$6.1^{+0.6+0.9}_{-0.7-0.6}$ 29k FULSOM 18 BELL $\Upsilon(2S) \rightarrow \gamma X$

$3.9 \pm 1.1^{+1.1}_{-0.9}$ $13 \pm 5k$ ¹AUBERT 09AQ BABR $\Upsilon(2S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21 90 LEES 11J BABR $\Upsilon(2S) \rightarrow X\gamma$

<8.4 90 ¹BONVICINI 10 CLEO $\Upsilon(2S) \rightarrow \gamma X$

<5.1 90 ²ARTUSO 05 CLEO $e^+e^- \rightarrow \gamma X$

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.

² Superseded by BONVICINI 10.

NODE=M052R15
NODE=M052R15

NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

 $\Gamma(\gamma\eta_b(1S) \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.7 \times 10^{-6}$	90	SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R25
NODE=M052R25

 $\Gamma(\gamma X_{b\bar{b}} \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4.9	90		SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R26
NODE=M052R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

$46.2^{+29.7}_{-14.2} \pm 10.6$ 10 ¹DOBBS 12 $\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R26;LINKAGE=DO

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{90}/Γ

(1.5 GeV $< m_X < 5.0$ GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.95	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M052R19

NODE=M052R19
NODE=M052R19

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$ Γ_{91}/Γ

(0.3 GeV $< m_{A^0} < 7$ GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8 \times 10^{-5}$	90	¹ LEES	11H BABR	$\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R06

NODE=M052R06
NODE=M052R06

¹ For a narrow scalar or pseudoscalar, A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M052R06;LINKAGE=LE

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	¹ AUBERT	09Z BABR	$e^+e^- \rightarrow A^0 \rightarrow \gamma \mu^+ \mu^-$

NODE=M052R24
NODE=M052R24

¹ For a narrow scalar or pseudoscalar, A^0 , with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} range from 0.26–8.3 $\times 10^{-6}$.

NODE=M052R24;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

$\Gamma(e^\pm \tau^\mp) / \Gamma_{\text{total}}$ Γ_{93} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.12 (CL = 90%)		[<3.2 × 10 ⁻⁶ (CL = 90%) OUR 2024 BEST LIMIT]		
<1.12	90	DHAMIJA	24	BELL $e^+ e^- \rightarrow e^\pm \tau^\mp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<3.2	90	LEES	10B	BABR $e^+ e^- \rightarrow e^\pm \tau^\mp$

NODE=M052230

NODE=M052R04
NODE=M052R04

$\Gamma(\mu^\pm \tau^\mp) / \Gamma_{\text{total}}$ Γ_{94} / Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.23 (CL = 90%)		[<3.3 × 10 ⁻⁶ (CL = 90%) OUR 2024 BEST LIMIT]		
< 0.23	90	DHAMIJA	24	BELL $e^+ e^- \rightarrow \mu^\pm \tau^\mp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 3.3	90	LEES	10B	BABR $e^+ e^- \rightarrow \mu^\pm \tau^\mp$
<14.4	95	LOVE	08A	CLEO $e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M052R20
NODE=M052R20

$\mathcal{T}(2S)$ Cross-Particle Branching Ratios

NODE=M052240

$B(\mathcal{T}(2S) \rightarrow \pi^+ \pi^-) \times B(\mathcal{T}(3S) \rightarrow \mathcal{T}(2S) X)$

NODE=M052R05
NODE=M052R05

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.78 ± 0.02 ± 0.11	906k	LEES	11C	BABR $e^+ e^- \rightarrow \pi^+ \pi^- X$

$\mathcal{T}(2S)$ REFERENCES

NODE=M052

AAIJ	24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
DHAMIJA	24	JHEP 2402 187	R. Dhamija <i>et al.</i>	(BELLE Collab.)	REFID=62686
GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)	REFID=62519
SHAMOV	23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)	REFID=59535
JIA	18	PR D97 112004	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58949
JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=57635
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)	REFID=55590
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
TAMPONI	13	PR D87 011104	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=54919
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>		REFID=54288
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=516775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
WANG	11B	PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=53939
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
BESSON	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)	REFID=44651
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	REFID=41861
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	REFID=41224
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40731
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE $e^+ e^-$ Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	REFID=40021
BARU	86B	ZPHY C32 622 (errat.)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22334
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
GELPHMAN	85	PR D32 2893	D. Gelpman <i>et al.</i>	(Crystal Ball Collab.)	REFID=22336
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>		REFID=22327; ERROR=9
BESSON	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22279
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)	REFID=22329
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22332
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	REFID=22270
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22319
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22318
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	REFID=22264

$\Upsilon_2(1D)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

was $\Upsilon(1D)$

First observed by BONVICINI 04 in the decay to $\gamma\gamma \Upsilon(1S)$ and confirmed by DEL-AMO-SANCHEZ 10R in the decay to $\pi^+\pi^- \Upsilon(1S)$.

Data consistent with $J^P = 2^-$. The states with $J = 1$ and 3 also possibly seen, but need confirmation.

NODE=M177

NODE=M177

$\Upsilon_2(1D)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10163.7 ± 1.4 OUR AVERAGE		Error includes scale factor of 1.7.		
10164.5 ± 0.8 ± 0.5		DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1 ± 0.6 ± 1.6	38	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

NODE=M177M

NODE=M177M

$\Upsilon_2(1D)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma \Upsilon(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	seen
$\Gamma_3 \quad \eta \Upsilon(1S)$	not seen
$\Gamma_4 \quad \pi^+\pi^- \Upsilon(1S)$	$(6.6 \pm 1.6) \times 10^{-3}$

NODE=M177215;NODE=M177

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4

$\Upsilon_2(1D)$ BRANCHING RATIOS

$\Gamma(\eta \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	90	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$	

NODE=M177225

NODE=M177R01

NODE=M177R01

$\Gamma(\pi^+\pi^- \Upsilon(1S))/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE (units 10^{-2})		DOCUMENT ID	TECN	COMMENT	
$0.66^{+0.15}_{-0.14} \pm 0.06$		¹ DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$	

NODE=M177R03

NODE=M177R03

¹ Using theoretical predictions for $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon_2(1D))$.

NODE=M177R03;LINKAGE=DE

$\Gamma(\pi^+\pi^- \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$					Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.2	90	² BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$	

NODE=M177R02

NODE=M177R02

² Assuming $J = 2$.

NODE=M177R02;LINKAGE=BO

$\Upsilon_2(1D)$ REFERENCES

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

NODE=M177

REFID=53634

REFID=49759

$\chi_{b0}(2P)$

$I^G(J^{PC}) = 0^+(0^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M079

NODE=M079

$\chi_{b0}(2P)$ MASS

VALUE (MeV) DOCUMENT ID
10232.5 ± 0.4 ± 0.5 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M

NODE=M079M
 → UNCHECKED ←

$m_{\chi_{b1}(2P)} = m_{\chi_{b0}(2P)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
23.8 ± 1.7	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M079M2
 NODE=M079M2

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
121.9 ± 0.4 OUR EVALUATION		Treating systematic errors as correlated		
122.2 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
121.55 ± 0.16 ± 0.46		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
123.0 ± 0.8	4959	¹ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
124.6 ± 1.4	17	² HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
122.3 ± 0.3 ± 0.6	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

NODE=M079DM

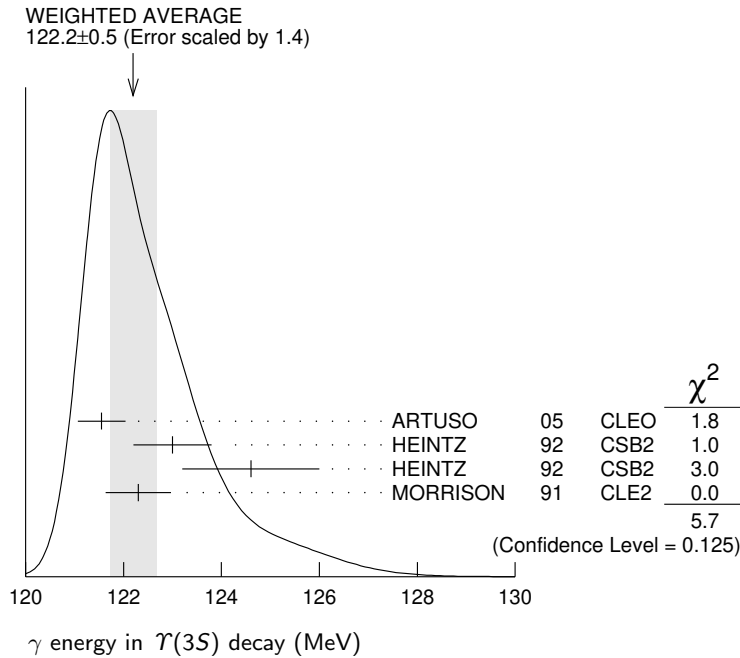
NODE=M079DM
 → UNCHECKED ←

OCCUR=2

¹ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M079DM;LINKAGE=A

NODE=M079DM;LINKAGE=B



$\chi_{b0}(2P)$ DECAY MODES

NODE=M079215;NODE=M079

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(2S)$	(1.38 ± 0.30) %	DESIG=2
Γ_2 $\gamma \Upsilon(1S)$	(3.8 ± 1.7) × 10 ⁻³	DESIG=1
Γ_3 $D^0 X$	< 8.2 %	90% DESIG=3
Γ_4 $\pi^+\pi^-K^+K^-\pi^0$	< 3.4 × 10 ⁻⁵	90% DESIG=4
Γ_5 $2\pi^+\pi^-K^-K_S^0$	< 5 × 10 ⁻⁵	90% DESIG=5
Γ_6 $2\pi^+\pi^-K^-K_S^0 2\pi^0$	< 2.2 × 10 ⁻⁴	90% DESIG=6
Γ_7 $2\pi^+ 2\pi^- 2\pi^0$	< 2.4 × 10 ⁻⁴	90% DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^-$	< 1.5 × 10 ⁻⁴	90% DESIG=8

Γ_9	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times 10^{-4}$	90%	DESIG=9
Γ_{10}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times 10^{-3}$	90%	DESIG=10
Γ_{11}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=11
Γ_{12}	$3\pi^+ 3\pi^-$	< 7	$\times 10^{-5}$	90%	DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times 10^{-3}$	90%	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=15
Γ_{16}	$4\pi^+ 4\pi^-$	< 1.7	$\times 10^{-4}$	90%	DESIG=16
Γ_{17}	$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times 10^{-4}$	90%	DESIG=17

$\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$

 Γ_1/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M079R2
NODE=M079R2

1.38 ± 0.30 OUR AVERAGE

1.31 ± 0.27 ^{+0.13} _{-0.12}	3,4	LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
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3.6 ± 1.6 ± 0.3	3,5	HEINTZ	92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.8	90	6	LEES	11J	BABR	$\Upsilon(3S) \rightarrow X \gamma$
------	----	---	------	-----	------	-------------------------------------

<8.9	90	7	CRAWFORD	92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
------	----	---	----------	-----	------	---

³ Assuming $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

NODE=M079R2;LINKAGE=D
NODE=M079R2;LINKAGE=E

⁴ LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] = (7.7 \pm 1.6) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91.

NODE=M079R2;LINKAGE=C

⁶ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.

NODE=M079R2;LINKAGE=LE

⁷ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) < 1.19 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R2;LINKAGE=B

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$

 Γ_2/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M079R1
NODE=M079R1

0.38 ± 0.17 OUR AVERAGE

0.36 ± 0.17 ± 0.03	8,9,10	LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
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0.9 ± 0.7 ± 0.1	9,11	HEINTZ	92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
-----------------	------	--------	----	------	---

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	12	LEES	11J	BABR	$\Upsilon(3S) \rightarrow X \gamma$
------	----	----	------	-----	------	-------------------------------------

<2.5	90	13	CRAWFORD	92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
------	----	----	----------	-----	------	---

⁸ LEES 14M quotes $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (2.1 \pm 1.0) \times 10^{-4}$ combining the results from $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ samples with and without photon conversions.

NODE=M079R1;LINKAGE=D

⁹ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M079R1;LINKAGE=E

¹⁰ LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] = (2.1 \pm 1.0) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M079R1;LINKAGE=F

¹¹ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M079R1;LINKAGE=C

¹² LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.

NODE=M079R1;LINKAGE=LE

¹³ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) < 0.63 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R1;LINKAGE=B

$\Gamma(D^0 X)/\Gamma_{\text{total}}$

 Γ_3/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M079R01
NODE=M079R01

<8.2 × 10 ⁻²	90	14,15	BRIERE	08	CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$
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¹⁴ For $p_{D^0} > 2.5$ GeV/c.

NODE=M079R01;LINKAGE=BR

¹⁵ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01;LINKAGE=RI

$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.34	90	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$ 16 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R02
NODE=M079R02

NODE=M079R02;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$ 17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R03
NODE=M079R03

NODE=M079R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$ 18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R04
NODE=M079R04

NODE=M079R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$ 19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R05
NODE=M079R05

NODE=M079R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$ 20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R06
NODE=M079R06

NODE=M079R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$ 21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R07
NODE=M079R07

NODE=M079R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$ 22 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 63 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R08
NODE=M079R08

NODE=M079R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$ 23 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 39 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R09
NODE=M079R09

NODE=M079R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+3\pi^-$ 24 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 4 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R10
NODE=M079R10

NODE=M079R10;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 25 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 72×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R11
NODE=M079R11

NODE=M079R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 26 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 9×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R12
NODE=M079R12

NODE=M079R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 27 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 43×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R13
NODE=M079R13

NODE=M079R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 28 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 10×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R14
NODE=M079R14

NODE=M079R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	29 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$ 29 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 38×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R15
NODE=M079R15

NODE=M079R15;LINKAGE=AS

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	30 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 30 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B01
NODE=M079B01

NODE=M079B01;LINKAGE=LE

 $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.4 ± 0.9 OUR AVERAGE			

NODE=M079A02
NODE=M079A02

$1.7^{+1.5+0.1}_{-1.4-1.2}$	31 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$1.3 \pm 1.0 \pm 0.3$	32 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
31 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.			
32 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.			

NODE=M079A02;LINKAGE=A
NODE=M079A02;LINKAGE=K $[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.71 ± 0.80	33 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
33 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.			

NODE=M079A00
NODE=M079A00

NODE=M079A00;LINKAGE=A

 $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	34 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$ 34 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) < 2.8\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B02
NODE=M079B02

NODE=M079B02;LINKAGE=LE

$B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

4.4 ± 1.6 OUR AVERAGE

6.6 ^{+4.9+2.0} _{-4.0-0.3}	35	LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
4.0 ± 1.7 ± 0.3	36	HEINTZ	92	CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

³⁵ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.

³⁶ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.

NODE=M079A03
NODE=M079A03

NODE=M079A03;LINKAGE=A
NODE=M079A03;LINKAGE=B

$[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$

VALUE (%) DOCUMENT ID TECN COMMENT

3.31 ± 0.56

37	LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
----	------	-----	------	--

³⁷ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.

NODE=M079A01
NODE=M079A01

NODE=M079A01;LINKAGE=A

$\chi_{b0}(2P)$ REFERENCES

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M079

REFID=56343
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

$\chi_{b1}(2P)$

$J^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M080

NODE=M080

$\chi_{b1}(2P)$ MASS

VALUE (MeV)	DOCUMENT ID
10255.46 ± 0.22 ± 0.50 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M080M

NODE=M080M
→ UNCHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
23.5 ± 0.7 ± 0.7	¹ HEINTZ	92	CSB2 $e^+ e^- \rightarrow \gamma X, \ell^+ \ell^- \gamma \gamma$

NODE=M080M2

NODE=M080M2

¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M080M2;LINKAGE=A

$m_{\chi_{b1}(2P)} - m_{\Upsilon(1S)}$

NODE=M080A02

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
793.57 ± 0.75 ± 0.22	50	² AAIJ	24AC	LHCB $\chi_{b1}(2P) \rightarrow \Upsilon(1S) \mu^+ \mu^-$

NODE=M080A02

² Observed in prompt pp production.

NODE=M080A02;LINKAGE=A

γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M080DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
99.26 ± 0.22 OUR EVALUATION				Treating systematic errors as correlated
99.53 ± 0.23 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
99.15 ± 0.07 ± 0.25		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
99 ± 1	169	CRAWFORD	92B	CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
100.1 ± 0.4	11147	³ HEINTZ	92	CSB2 $e^+ e^- \rightarrow \gamma X$
100.2 ± 0.5	223	⁴ HEINTZ	92	CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
99.5 ± 0.1 ± 0.5	25759	MORRISON	91	CLE2 $e^+ e^- \rightarrow \gamma X$

NODE=M080DM

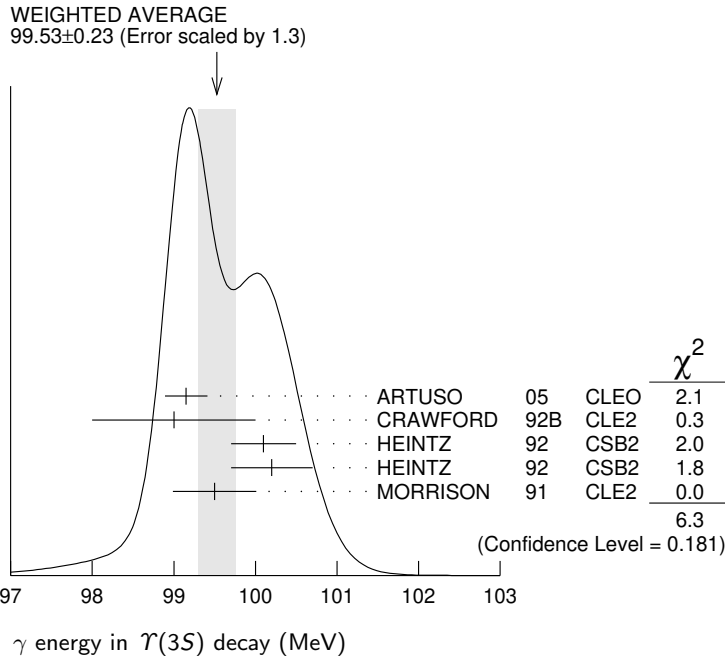
NODE=M080DM
→ UNCHECKED ←

OCCUR=2

³A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
⁴A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B



$\chi_{b1}(2P)$ DECAY MODES

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	
Γ_1 $\omega \Upsilon(1S)$	(1.63 ^{+0.40} _{-0.34}) %	DESIG=3
Γ_2 $\gamma \Upsilon(2S)$	(18.1 ± 1.9) %	DESIG=2
Γ_3 $\gamma \Upsilon(1S)$	(9.9 ± 1.0) %	DESIG=1
Γ_4 $\pi\pi \chi_{b1}(1P)$	(9.1 ± 1.3) × 10 ⁻³	DESIG=4
Γ_5 $D^0 X$	(8.8 ± 1.7) %	DESIG=5
Γ_6 $\pi^+ \pi^- K^+ K^- \pi^0$	(3.1 ± 1.0) × 10 ⁻⁴	DESIG=6
Γ_7 $2\pi^+ \pi^- K^- K_S^0$	(1.1 ± 0.5) × 10 ⁻⁴	DESIG=7
Γ_8 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	(7.7 ± 3.2) × 10 ⁻⁴	DESIG=8
Γ_9 $2\pi^+ 2\pi^- 2\pi^0$	(5.9 ± 2.0) × 10 ⁻⁴	DESIG=9
Γ_{10} $2\pi^+ 2\pi^- K^+ K^-$	(10 ± 4) × 10 ⁻⁵	DESIG=10
Γ_{11} $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(5.5 ± 1.8) × 10 ⁻⁴	DESIG=11
Γ_{12} $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(10 ± 4) × 10 ⁻⁴	DESIG=12
Γ_{13} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(6.7 ± 2.6) × 10 ⁻⁴	DESIG=13
Γ_{14} $3\pi^+ 3\pi^-$	(1.2 ± 0.4) × 10 ⁻⁴	DESIG=14
Γ_{15} $3\pi^+ 3\pi^- 2\pi^0$	(1.2 ± 0.4) × 10 ⁻³	DESIG=15
Γ_{16} $3\pi^+ 3\pi^- K^+ K^-$	(2.0 ± 0.8) × 10 ⁻⁴	DESIG=16
Γ_{17} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(6.1 ± 2.2) × 10 ⁻⁴	DESIG=17
Γ_{18} $4\pi^+ 4\pi^-$	(1.7 ± 0.6) × 10 ⁻⁴	DESIG=18
Γ_{19} $4\pi^+ 4\pi^- 2\pi^0$	(1.9 ± 0.7) × 10 ⁻³	DESIG=19

$\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

$\Gamma(\omega \Upsilon(1S))/\Gamma_{total}$	Γ_1/Γ
VALUE (units 10 ⁻²)	
EVTS	DOCUMENT ID
TECN	COMMENT
1.63^{+0.35+0.16}_{-0.31-0.15}	
32.6 ^{+6.9} _{-6.1}	⁵ CRONIN-HEN..04
	CLE3
	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

NODE=M080R3
 NODE=M080R3

⁵Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2 B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M080R3;LINKAGE=CR

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.181±0.019 OUR AVERAGE				
0.211±0.017±0.019		6,7,8 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.190±0.018±0.017	4.3k	⁹ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.206±0.035±0.019		6,10 CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.132±0.018±0.012		6,11 HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M080R2
 NODE=M080R2

⁶ Assuming $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

⁷ LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}} = (2.66 \pm 0.22)\%$ combining the results from $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ samples with and without photon conversions.

NODE=M080R2;LINKAGE=D
 NODE=M080R2;LINKAGE=E

⁸ LEES 14M reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (2.66 \pm 0.22) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R2;LINKAGE=F

⁹ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (2.4 \pm 0.1 \pm 0.2) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R2;LINKAGE=LE

¹⁰ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \ell^+\ell^-) = (10.23 \pm 1.20 \pm 1.26) 10^{-4}$.

NODE=M080R2;LINKAGE=B

¹¹ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) = (2.29 \pm 0.23 \pm 0.21) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91.

NODE=M080R2;LINKAGE=C

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.099±0.010 OUR AVERAGE				
0.107±0.006±0.010		12,13,14 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.098±0.005±0.009	15k	¹⁵ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.103±0.023±0.009		12,16 CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.075±0.010±0.007		12,17 HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M080R1
 NODE=M080R1

¹² Assuming $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

¹³ LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}} = (13.48 \pm 0.72) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and without converted photons.

NODE=M080R1;LINKAGE=D
 NODE=M080R1;LINKAGE=E

¹⁴ LEES 14M reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (13.48 \pm 0.72) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R1;LINKAGE=G

¹⁵ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))] = (12.4 \pm 0.3 \pm 0.6) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R1;LINKAGE=LE

¹⁶ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (6.47 \pm 1.12 \pm 0.82) 10^{-4}$.

NODE=M080R1;LINKAGE=B

¹⁷ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M080R1;LINKAGE=F

 $\Gamma(\pi\pi\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.3 OUR AVERAGE				
9.2±1.1±0.8	31k	¹⁸ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
8.6±2.3±2.1		¹⁹ CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

NODE=M080R4
 NODE=M080R4

¹⁸ LEES 11c measures $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) \times B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) = (1.16 \pm 0.07 \pm 0.12) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)\gamma) = (12.6 \pm 1.2) \times 10^{-2}$.

NODE=M080R4;LINKAGE=LE

¹⁹ CAWLFIELD 06 quote $\Gamma(\chi_b(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M080R4;LINKAGE=CA

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.8±1.5±0.8				
	2243	²⁰ BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

NODE=M080R01
 NODE=M080R01

²⁰ For $p_{D^0} > 2.5$ GeV/c.

NODE=M080R01;LINKAGE=BR

$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$
<p>21 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(39 \pm 8 \pm 9) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R02
 NODE=M080R02

NODE=M080R02;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
<p>22 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(14 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R03
 NODE=M080R03

NODE=M080R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
<p>23 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(97 \pm 30 \pm 26) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R04
 NODE=M080R04

NODE=M080R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.5	36	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
<p>24 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(74 \pm 16 \pm 19) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R05
 NODE=M080R05

NODE=M080R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.4±0.1	12	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
<p>25 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R06
 NODE=M080R06

NODE=M080R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.7±0.5	38	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
<p>26 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(69 \pm 13 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R07
 NODE=M080R07

NODE=M080R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±3.5±0.9	27	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
<p>27 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(121 \pm 29 \pm 33) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R08
 NODE=M080R08

NODE=M080R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±2.5±0.6	17	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
<p>28 ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$ = $(85 \pm 23 \pm 22) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.</p>				

NODE=M080R09
 NODE=M080R09

NODE=M080R09;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.4±0.1	18	²⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$
²⁹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (15 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R10
NODE=M080R10

NODE=M080R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	44	³⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
³⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (150 \pm 30 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R11
NODE=M080R11

NODE=M080R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.7±0.2	16	³¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
³¹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (25 \pm 7 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R12
NODE=M080R12

NODE=M080R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.1±0.6	25	³² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
³² ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (77 \pm 17 \pm 21) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R13
NODE=M080R13

NODE=M080R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.2	16	³³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
³³ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (22 \pm 6 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R14
NODE=M080R14

NODE=M080R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19±7±2	41	³⁴ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
³⁴ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (241 \pm 47 \pm 72) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) =$ $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R15
NODE=M080R15

NODE=M080R15;LINKAGE=AS

 $\chi_{b1}(2P)$ Cross-Particle Branching Ratios

NODE=M080230

 $\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$
 $\Gamma_3/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

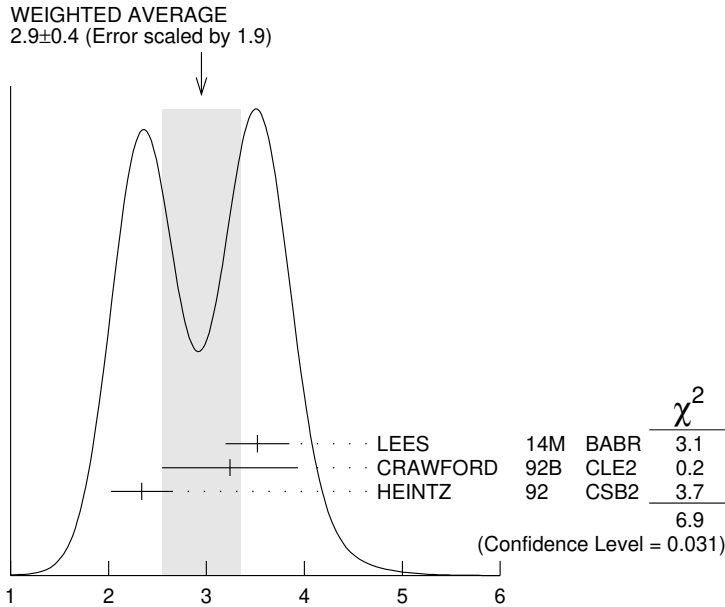
NODE=M080B01
NODE=M080B01 $B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$ NODE=M080A00
NODE=M080A00

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ±0.4 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
3.52 ^{+0.28} _{-0.27} ±0.17 _{-0.18}		³⁵ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
3.24 ±0.56 ±0.41	58	³⁶ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.34 ±0.28 ±0.15		³⁷ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

- 35 From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon.
- 36 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))$
 $B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$.
- 37 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$.

NODE=M080A00;LINKAGE=A
 NODE=M080A00;LINKAGE=C

NODE=M080A00;LINKAGE=B



$$B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$$

(units 10^{-4})

$$\frac{\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{21}(\Upsilon(3S))}{\Gamma(\Upsilon(3S))}$$

NODE=M080B02
 NODE=M080B02

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 ± 0.1 ± 0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

$$B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+\ell^-)$$

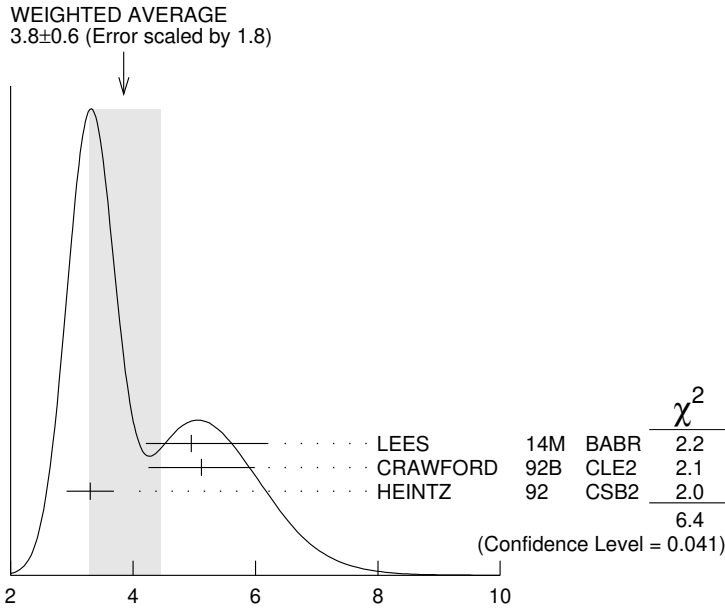
NODE=M080A01
 NODE=M080A01

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
$4.95^{+0.75}_{-0.70} \pm 1.01 \pm 0.24$		38 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$5.12 \pm 0.60 \pm 0.63$	111	39 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
$3.30 \pm 0.33 \pm 0.20$		40 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$

- 38 From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon.
- 39 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))$
 $B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$.
- 40 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) = (2.29 \pm 0.23 \pm 0.21)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$.

NODE=M080A01;LINKAGE=A
 NODE=M080A01;LINKAGE=C

NODE=M080A01;LINKAGE=B



$$B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$$

(units 10^{-4})

$$B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P) \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b1}(2P) X)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.16±0.07±0.12	31k	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$

NODE=M080R16
NODE=M080R16

$$B(\chi_{b2}(2P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.109±0.007±0.040	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R20
NODE=M080R20

$$B(\chi_{b0}(2P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(2P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE	DOCUMENT ID	TECN	COMMENT
1.082±0.025±0.060	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R21
NODE=M080R21

$\chi_{b1}(2P)$ REFERENCES

NODE=M080

AAIJ	24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51887
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)	REFID=50997
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
CRONIN-HENNESSY	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=49766
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)	REFID=43177
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)	REFID=41586

$h_b(2P)$

$$J^{PC} = 0^-(1^{+-})$$

Quantum numbers are quark model predictions. $C = -$ established by $\eta_b \gamma$ decay.

NODE=M205

NODE=M205

 $h_b(2P)$ MASS

NODE=M205M

NODE=M205M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10259.8 ± 0.5 ± 1.1	90k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \pi^+\pi^-$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
10259.8 ± 0.6 ^{+1.4} _{-1.0}	83.9k	² ADACHI	12 BELL	10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM

¹ Observed with 9 standard deviations significance.

² Superseded by MIZUK 12.

NODE=M205M;LINKAGE=A
NODE=M205M;LINKAGE=AD

 $h_b(2P)$ DECAY MODES

NODE=M205215;NODE=M205

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	not seen	
Γ_2 $\eta_b(1S)\gamma$	(22 ± 5) %	
Γ_3 $\eta_b(2S)\gamma$	(48 ± 13) %	
Γ_4 $\Upsilon(1S)\eta$	(7.1 ⁺ ₋ 4.0 ⁺ _{3.3}) × 10 ⁻³	
Γ_5 $\Upsilon(1S)\pi^0$	< 1.8 × 10 ⁻³	90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

 $h_b(2P)$ BRANCHING RATIOS

NODE=M205225

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
not seen	83.9k	ADACHI	12 BELL	10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM	

NODE=M205R01
NODE=M205R01

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT	
22.3 ± 3.8^{+3.1}_{-3.3}	10k	MIZUK	12 BELL	$e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons	

NODE=M205R02
NODE=M205R02

$\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT	
47.5 ± 10.5^{+6.8}_{-7.7}	26k	MIZUK	12 BELL	$e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons	

NODE=M205R03
NODE=M205R03

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT	
7.1^{+3.7}_{-3.2} ± 0.8	3.8	KOVALENKO	24 BELL	$e^+e^- \rightarrow \Upsilon(5S)$	

NODE=M205R00
NODE=M205R00

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 1.8 × 10⁻³	90	0.1	KOVALENKO	24 BELL	$e^+e^- \rightarrow \Upsilon(5S)$

NODE=M205R04
NODE=M205R04

 $h_b(2P)$ REFERENCES

NODE=M205

KOVALENKO	24	PRL 133 261901	E. Kovalenko <i>et al.</i>	(BELLE Collab.)	REFID=63017
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)	REFID=53962
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=54718

$\chi_{b2}(2P)$

$J^G(J^{PC}) = 0^+(2^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M081

NODE=M081

$\chi_{b2}(2P)$ MASS

NODE=M081M

VALUE (MeV) DOCUMENT ID
10268.65 ± 0.22 ± 0.50 OUR EVALUATION From $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M081M
 → UNCHECKED ←

$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

NODE=M081M2

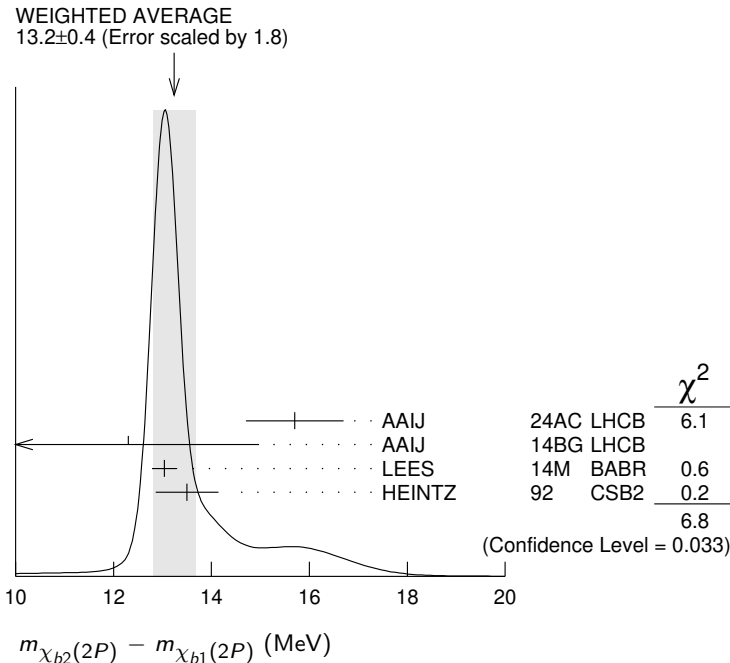
VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
13.2 ± 0.4 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.
 [13.10 ± 0.24 MeV OUR 2024 AVERAGE]

NODE=M081M2
 NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
15.7 ± 1.0	50	¹ AAIJ	24AC LHCb	$\chi_{b2}(2P) \rightarrow \Upsilon(1S)\mu^+\mu^-$
12.3 ± 2.6 ± 0.6		² AAIJ	14BG LHCb	$pp \rightarrow \gamma\mu^+\mu^-X$
13.04 ± 0.26		LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
13.5 ± 0.4 ± 0.5		³ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$

NODE=M081M2;LINKAGE=C
 NODE=M081M2;LINKAGE=B
 NODE=M081M2;LINKAGE=A

- ¹ Observed in prompt pp production.
- ² From the $\chi_{bj}(2P) \rightarrow \Upsilon(1S)\gamma$ transition.
- ³ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.



γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M081DM

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
86.19 ± 0.22 OUR EVALUATION Treating systematic errors as correlated
86.40 ± 0.18 OUR AVERAGE

NODE=M081DM
 → UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
86.04 ± 0.06 ± 0.27		ARTUSO	05 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
86 ± 1	101	CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
86.7 ± 0.4	10319	⁴ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
86.9 ± 0.4	157	⁵ HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
86.4 ± 0.1 ± 0.4	30741	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

OCCUR=2

- ⁴ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
- ⁵ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM;LINKAGE=A
 NODE=M081DM;LINKAGE=B

$\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $\omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30})\%$		DESIG=3
Γ_2 $\gamma \Upsilon(2S)$	$(8.9 \pm 1.2)\%$		DESIG=2
Γ_3 $\gamma \Upsilon(1S)$	$(6.6 \pm 0.8)\%$		DESIG=1
Γ_4 $\pi\pi\chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$		DESIG=4
Γ_5 $D^0 X$	< 2.4	%	90% DESIG=5
Γ_6 $\pi^+\pi^-K^+K^-\pi^0$	< 1.1	$\times 10^{-4}$	90% DESIG=6
Γ_7 $2\pi^+\pi^-K^-K_S^0$	< 9	$\times 10^{-5}$	90% DESIG=7
Γ_8 $2\pi^+\pi^-K^-K_S^0 2\pi^0$	< 7	$\times 10^{-4}$	90% DESIG=8
Γ_9 $2\pi^+ 2\pi^- 2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$		DESIG=9
Γ_{10} $2\pi^+ 2\pi^- K^+ K^-$	$(9 \pm 4) \times 10^{-5}$		DESIG=10
Γ_{11} $2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$		DESIG=11
Γ_{12} $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$		DESIG=12
Γ_{13} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 4	$\times 10^{-4}$	90% DESIG=13
Γ_{14} $3\pi^+ 3\pi^-$	$(9 \pm 4) \times 10^{-5}$		DESIG=14
Γ_{15} $3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		DESIG=15
Γ_{16} $3\pi^+ 3\pi^- K^+ K^-$	$(1.4 \pm 0.7) \times 10^{-4}$		DESIG=16
Γ_{17} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$		DESIG=17
Γ_{18} $4\pi^+ 4\pi^-$	$(9 \pm 5) \times 10^{-5}$		DESIG=18
Γ_{19} $4\pi^+ 4\pi^- 2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$		DESIG=19

 $\chi_{b2}(2P)$ BRANCHING RATIOS

NODE=M081220

 $\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ NODE=M081R3
NODE=M081R3

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$	⁶ CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma\omega \Upsilon(1S)$

⁶Using $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M081R3;LINKAGE=CR

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ NODE=M081R2
NODE=M081R2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.089\pm0.012 OUR AVERAGE				
$0.085 \pm 0.010 \pm 0.010$	^{7,8,9}	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$0.084 \pm 0.011 \pm 0.010$	¹⁰	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
$0.096 \pm 0.022 \pm 0.012$	^{8,11}	CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.106 \pm 0.016 \pm 0.013$	^{8,12}	HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

⁷LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))/\Gamma_{\text{total}}$
 $= (1.12 \pm 0.13)\%$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and
without converted photons.

NODE=M081R2;LINKAGE=D

⁸Assuming $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

NODE=M081R2;LINKAGE=E

⁹LEES 14M reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] =$
 $(1.12 \pm 0.13) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

NODE=M081R2;LINKAGE=F

¹⁰LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] =$
 $(1.1 \pm 0.1 \pm 0.1) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error
is the systematic error from using our best value.

NODE=M081R2;LINKAGE=LE

¹¹CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2$
 $B(\Upsilon(2S) \rightarrow \ell^+\ell^-) = (4.98 \pm 0.94 \pm 0.62) 10^{-4}$.

NODE=M081R2;LINKAGE=B

¹²Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow$
 $\gamma \Upsilon(2S)) = (1.90 \pm 0.23 \pm 0.18) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$.
Supersedes HEINTZ 91.

NODE=M081R2;LINKAGE=C

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M081R1
NODE=M081R1

0.066±0.008 OUR AVERAGE

0.061±0.004±0.007	13,14,15	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.070±0.004±0.008	11k	¹⁶ LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$
0.077±0.018±0.009	14,17	CRAWFORD	92B	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.061±0.009±0.007	14,18	HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹³LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))/\Gamma_{\text{total}} = (8.03 \pm 0.50) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and without converted photons.

NODE=M081R1;LINKAGE=D

¹⁴Assuming $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M081R1;LINKAGE=E

¹⁵LEES 14M reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] = (8.03 \pm 0.50) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=F

¹⁶LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] = (9.2 \pm 0.3 \pm 0.4) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=LE

¹⁷CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (5.03 \pm 0.94 \pm 0.63) 10^{-4}$.

NODE=M081R1;LINKAGE=B

¹⁸Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M081R1;LINKAGE=C

 $\Gamma(\pi\pi\chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
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NODE=M081R4
NODE=M081R4

5.1±0.9 OUR AVERAGE

4.9±0.7±0.6	17k	¹⁹ LEES	11c	BABR $e^+e^- \rightarrow \pi^+\pi^-X$
6.0±1.6±1.4		²⁰ CAWLFIELD	06	CLE3 $\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

¹⁹ $(0.64 \pm 0.05 \pm 0.08) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)\gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

NODE=M081R4;LINKAGE=LE

²⁰CAWLFIELD 06 quote $\Gamma(\chi_{b2}(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M081R4;LINKAGE=CA

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M081R01
NODE=M081R01

<2.4 × 10⁻² 90 ^{21,22}BRIERE 08 CLEO $\Upsilon(3S) \rightarrow \gamma D^0 X$

²¹For $p_{D^0} > 2.5$ GeV/c.

NODE=M081R01;LINKAGE=BR

²²The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

NODE=M081R01;LINKAGE=RI

 $\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M081R02
NODE=M081R02

<1.1 90 ²³ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

²³ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R02;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M081R03
NODE=M081R03

<0.9 90 ²⁴ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

²⁴ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] < 12 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M081R04
NODE=M081R04

<7 90 ²⁵ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

²⁵ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P))] < 87 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±1.6±0.5	23	²⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

NODE=M081R05
 NODE=M081R05

²⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(51 \pm 16 \pm 13) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	11	²⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

NODE=M081R06
 NODE=M081R06

²⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±1.0±0.3	16	²⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

NODE=M081R07
 NODE=M081R07

²⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(32 \pm 11 \pm 8) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.7±2.2±0.6	14	²⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

NODE=M081R08
 NODE=M081R08

²⁹ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(62 \pm 23 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	³⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

NODE=M081R09
 NODE=M081R09

³⁰ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 < 58×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = 13.1×10^{-2} .

NODE=M081R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	14	³¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$

NODE=M081R10
 NODE=M081R10

³¹ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	45	³² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

NODE=M081R11
 NODE=M081R11

³² ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(159 \pm 33 \pm 43) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.4±0.7±0.2	12	³³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$

NODE=M081R12
 NODE=M081R12

³³ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$
 = $(19 \pm 7 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))$
 = $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R12;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.7±0.5	16	³⁴ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
³⁴ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$ = $(55 \pm 16 \pm 15) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R13
NODE=M081R13

NODE=M081R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	9	³⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
³⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$ = $(12 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R14
NODE=M081R14

NODE=M081R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13±5±2	27	³⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
³⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))]$ = $(165 \pm 46 \pm 50) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R15
NODE=M081R15

NODE=M081R15;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

 $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $\Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$ NODE=M081B01
NODE=M081B01

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.2±0.3±0.4	11k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

 $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$ NODE=M081B02
NODE=M081B02

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.1±0.1	2.5k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

 $B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X)$ NODE=M081R16
NODE=M081R16

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.64±0.05±0.08	17k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

 $B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$ NODE=M081A01
NODE=M081A01

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.02±0.18 OUR AVERAGE				
$1.95^{+0.22+0.10}_{-0.21-0.16}$		³⁷ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$2.52 \pm 0.47 \pm 0.32$	48	³⁸ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
$1.98 \pm 0.28 \pm 0.12$		³⁹ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$

³⁷ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with converted photons.NODE=M081A01;LINKAGE=A
NODE=M081A01;LINKAGE=C³⁸ CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS)) B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$.³⁹ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$.

NODE=M081A01;LINKAGE=B

 $[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ NODE=M081A00
NODE=M081A00

VALUE (%)	DOCUMENT ID	TECN	COMMENT
66.6±3.0	⁴⁰ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

⁴⁰ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ events without converted photons.

NODE=M081A00;LINKAGE=A

$B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.74 ± 0.29 OUR AVERAGE				
$3.22^{+0.58+0.16}_{-0.53-0.71}$		41 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$2.49 \pm 0.47 \pm 0.31$	53	42 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
$2.74 \pm 0.33 \pm 0.18$		43 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M081A02
NODE=M081A02

- 41 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.
- 42 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS)) B(\Upsilon(nS) \rightarrow \ell^+ \ell^-)$.
- 43 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) = (1.90 \pm 0.23 \pm 0.18) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10) \%$.

NODE=M081A02;LINKAGE=A
NODE=M081A02;LINKAGE=C

NODE=M081A02;LINKAGE=B

$[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
46.9 ± 2.0	44 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

NODE=M081A03
NODE=M081A03

- 44 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.

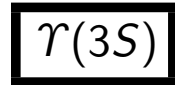
NODE=M081A03;LINKAGE=A

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AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
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NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M081

REFID=63036
REFID=56199
REFID=56343
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REFID=41580
REFID=41634
REFID=41586



$$J^{PC} = 0^-(1^{--})$$

NODE=M048

$\Upsilon(3S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.1 ± 0.5	1 SHAMOV	23 RVUE	$e^+ e^- \rightarrow$ hadrons
10355.2 ± 0.5	2,3 ARTAMONOV	00 MD1	$e^+ e^- \rightarrow$ hadrons
10355.3 ± 0.5	4,5 BARU	86B MD1	$e^+ e^- \rightarrow$ hadrons

NODE=M048M

NODE=M048M

• • • We do not use the following data for averages, fits, limits, etc. • • •

- ¹ Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.
- ² Reanalysis of BARU 86B using new electron mass (COHEN 87).
- ³ Superseded by SHAMOV 23.
- ⁴ Reanalysis of ARTAMONOV 84.
- ⁵ Superseded by ARTAMONOV 00.

NODE=M048M;LINKAGE=A

NODE=M048M;LINKAGE=AR

NODE=M048M;LINKAGE=B

NODE=M048M;LINKAGE=C

NODE=M048M;LINKAGE=RZ

$m \Upsilon(3S) - m \Upsilon(2S)$

NODE=M048DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
331.82 ± 0.08 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below. [331.50 ± 0.13 MeV OUR 2024 AVERAGE]				
$331.77 \pm 0.07 \pm 0.10$	1.8M	⁶ AAIJ	24AC LHCB	$\Upsilon \rightarrow \mu^+ \mu^-$
$331.88 \pm 0.03 \pm 0.04$	1.5k	⁶ AAIJ	24AC LHCB	$\Upsilon(3S) \rightarrow \Upsilon(2S) \pi^+ \pi^-$
$331.50 \pm 0.02 \pm 0.13$		LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$

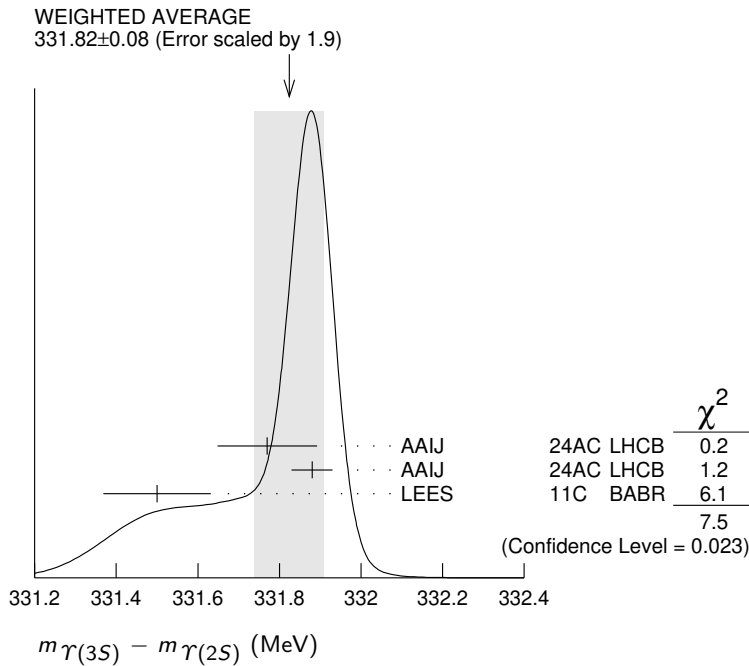
NODE=M048DM2

NEW

OCCUR=2

⁶ Observed in prompt $p\bar{p}$ production.

NODE=M048DM2;LINKAGE=A



$\Upsilon(3S)$ WIDTH

NODE=M048W

VALUE (keV) 20.32±1.85 OUR EVALUATION DOCUMENT ID See the Note on "Width Determinations of the Υ States"

NODE=M048W
→ UNCHECKED ←

$\Upsilon(3S)$ DECAY MODES

NODE=M048215;NODE=M048

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 $\Upsilon(2S)$ anything	(10.6 ± 0.8) %		DESIG=8
Γ_2 $\Upsilon(2S)\pi^+\pi^-$	(2.82± 0.18) %	S=1.6	DESIG=4
Γ_3 $\Upsilon(2S)\pi^0\pi^0$	(1.85± 0.14) %		DESIG=10
Γ_4 $\Upsilon(2S)\gamma\gamma$	(5.0 ± 0.7) %		DESIG=12
Γ_5 $\Upsilon(2S)\pi^0$	< 5.1 × 10 ⁻⁴	CL=90%	DESIG=107
Γ_6 $\Upsilon(1S)\pi^+\pi^-$	(4.37± 0.08) %		DESIG=3
Γ_7 $\Upsilon(1S)\pi^0\pi^0$	(2.20± 0.13) %		DESIG=11
Γ_8 $\Upsilon(1S)\eta$	< 1 × 10 ⁻⁴	CL=90%	DESIG=9
Γ_9 $\Upsilon(1S)\pi^0$	< 7 × 10 ⁻⁵	CL=90%	DESIG=106
Γ_{10} $h_b(1P)\pi^0$	< 1.2 × 10 ⁻³	CL=90%	DESIG=112
Γ_{11} $h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 ± 1.4) × 10 ⁻⁴		DESIG=113
Γ_{12} $h_b(1P)\pi^+\pi^-$	< 1.2 × 10 ⁻⁴	CL=90%	DESIG=114
Γ_{13} $\tau^+\tau^-$	(2.29± 0.30) %		DESIG=16
Γ_{14} $\mu^+\mu^-$	(2.18± 0.21) %	S=2.1	DESIG=1
Γ_{15} e^+e^-	(2.18± 0.20) %		DESIG=2
Γ_{16} hadrons	(93 ± 12) %		DESIG=101
Γ_{17} ggg	(35.7 ± 2.6) %		DESIG=109
Γ_{18} γgg	(9.7 ± 1.8) × 10 ⁻³		DESIG=110
Γ_{19} 2H anything	(2.33± 0.33) × 10 ⁻⁵		DESIG=117

Radiative decays

Γ	Decay	Value	CL	Node	Designation
Γ_{20}	$\gamma\chi_{b2}(2P)$	$(13.1 \pm 1.6) \%$	S=3.4	NODE=M048;CLUMP=B	DESIG=5
Γ_{21}	$\gamma\chi_{b1}(2P)$	$(12.6 \pm 1.2) \%$	S=2.4		DESIG=6
Γ_{22}	$\gamma\chi_{b0}(2P)$	$(5.9 \pm 0.6) \%$	S=1.4		DESIG=7
Γ_{23}	$\gamma\chi_{b2}(1P)$	$(10.0 \pm 1.0) \times 10^{-3}$	S=1.7		DESIG=103
Γ_{24}	$\gamma\chi_{b1}(1P)$	$(9 \pm 5) \times 10^{-4}$	S=1.8		DESIG=104
Γ_{25}	$\gamma\chi_{b0}(1P)$	$(2.7 \pm 0.4) \times 10^{-3}$			DESIG=13
Γ_{26}	$\gamma\eta_b(2S)$	$< 6.2 \times 10^{-4}$	CL=90%		DESIG=14
Γ_{27}	$\gamma\eta_b(1S)$	$(5.1 \pm 0.7) \times 10^{-4}$			DESIG=15
Γ_{28}	$\gamma A^0 \rightarrow \gamma \text{hadrons}$	$< 8 \times 10^{-5}$	CL=90%		DESIG=115
Γ_{29}	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] $< 2.2 \times 10^{-4}$	CL=95%		DESIG=102
Γ_{30}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$< 5.5 \times 10^{-6}$	CL=90%		DESIG=116
Γ_{31}	$\gamma A^0 \rightarrow \gamma \tau^+ \tau^-$	[b] $< 1.6 \times 10^{-4}$	CL=90%		DESIG=108

Lepton Family number (LF) violating modes

Γ	Decay	Value	CL	Node	Designation
Γ_{32}	$e^\pm \tau^\mp$	LF $< 4.2 \times 10^{-6}$	CL=90%	NODE=M048;CLUMP=C	DESIG=111
Γ_{33}	$e^\pm \mu^\mp$	LF $< 3.6 \times 10^{-7}$	CL=90%		DESIG=119
Γ_{34}	$\mu^\pm \tau^\mp$	LF $< 3.1 \times 10^{-6}$	CL=90%		DESIG=105

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C48

[b] For $m_{\tau^+ \tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

LINKAGE=MRG

 $\Upsilon(3S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M048218

 $\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{16} \Gamma_{15} / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
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NODE=M048G2
NODE=M048G2**0.414 ± 0.007 OUR AVERAGE**0.413 ± 0.004 ± 0.006 ROSNER 06 CLEO 10.4 $e^+ e^- \rightarrow \text{hadrons}$ 0.45 ± 0.03 ± 0.03 ⁷ GILES 84B CLEO $e^+ e^- \rightarrow \text{hadrons}$ ⁷ Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M048G2;LINKAGE=R

 $\Gamma(\Upsilon(1S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_6 \Gamma_{15} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
------------	------	-------------	------	---------

NODE=M048G01
NODE=M048G01**18.46 ± 0.27 ± 0.77** 6.4k ⁸ AUBERT 08BP BABR $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$ ⁸ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M048G01;LINKAGE=AU

 $\Upsilon(3S)$ PARTIAL WIDTHS

NODE=M048220

 $\Gamma(e^+ e^-)$ Γ_{15}

VALUE (keV)	DOCUMENT ID
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NODE=M048W2
NODE=M048W2**0.443 ± 0.008 OUR EVALUATION**

→ UNCHECKED ←

 $\Upsilon(3S)$ BRANCHING RATIOS

NODE=M048225

 $\Gamma(\Upsilon(2S) \text{anything}) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M048R8
NODE=M048R8**0.106 ± 0.008 OUR AVERAGE**0.1023 ± 0.0105 4625 ^{9,10,11} BUTLER 94B CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- X$ 0.111 ± 0.012 4891 ^{10,11,12} BROCK 91 CLEO $e^+ e^- \rightarrow \pi^+ \pi^- X,$
 $\pi^+ \pi^- \ell^+ \ell^-$ ⁹ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S) \gamma \gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^0 \pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-)$.

NODE=M048R;LINKAGE=A

¹⁰ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=B

¹¹ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-) = (18.5 \pm 0.8)\%$.

NODE=M048R;LINKAGE=D

¹² Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S) \gamma \gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^0 \pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=C

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{total}$

Γ_2/Γ

NODE=M048R4
NODE=M048R4

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82±0.18 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
3.00±0.02±0.14	543k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$
2.40±0.10±0.26	800	13 AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-e^+e^-$
3.12±0.49	980	14,15 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$
2.13±0.38	974	16 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X,$ $\pi^+\pi^-\ell^+\ell^-$

••• We do not use the following data for averages, fits, limits, etc. •••

4.82±0.65±0.53	138	16 WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.1 ±2.0	5	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

¹³ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

¹⁴ From the exclusive mode.

¹⁵ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

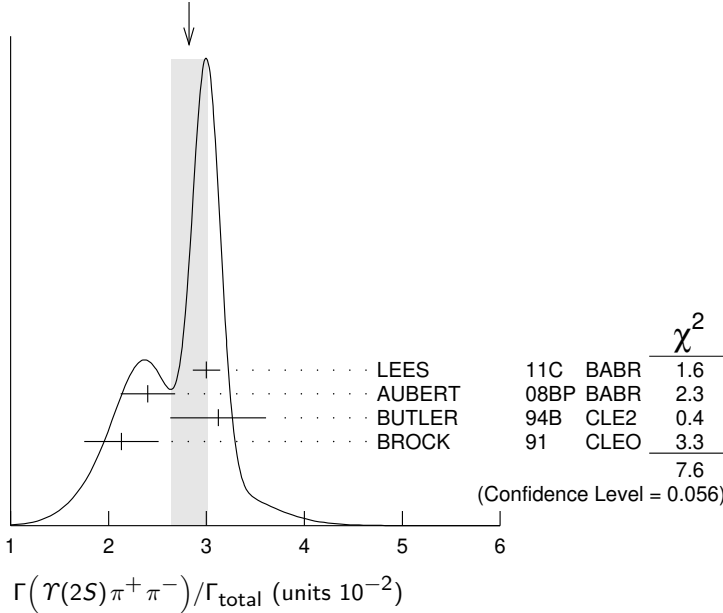
¹⁶ Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R4;LINKAGE=AU

NODE=M048R;LINKAGE=M
NODE=M048R4;LINKAGE=A

NODE=M048R4;LINKAGE=C

WEIGHTED AVERAGE
2.82±0.18 (Error scaled by 1.6)



$\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{total}$

Γ_3/Γ

NODE=M048R10
NODE=M048R10

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85±0.14 OUR AVERAGE				
1.82±0.09±0.12	4391	17 BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16±0.39		18,19 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.7 ±0.5 ±0.2	10	20 HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹⁷ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

¹⁸ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.

¹⁹ From the exclusive mode.

²⁰ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M048R10;LINKAGE=BH

NODE=M048R;LINKAGE=K
NODE=M048R10;LINKAGE=M
NODE=M048R;LINKAGE=G

$\Gamma(\Upsilon(2S)\gamma\gamma)/\Gamma_{total}$

Γ_4/Γ

NODE=M048R12
NODE=M048R12

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502±0.0069	21 BUTLER	94B CLE2	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

²¹ From the exclusive mode.

NODE=M048R12;LINKAGE=M

$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{total}$

Γ_5/Γ

NODE=M048R25
NODE=M048R25

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	22 HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

²² Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.37±0.08 OUR AVERAGE				
4.32±0.07±0.13	90k	23 LEES	11L BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	24 BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^-$ MM
4.17±0.06±0.19	6.4k	25 AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	26 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	26 WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	26 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$

••• We do not use the following data for averages, fits, limits, etc. •••

4.9 ±1.0	22	GREEN	82 CLEO	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ±1.3	26	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
²³ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.				
²⁴ A weighted average of the inclusive and exclusive results.				
²⁵ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.				
²⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.				

NODE=M048R3

NODE=M048R3

NODE=M048R3

NODE=M048R3;LINKAGE=LE

NODE=M048R3;LINKAGE=BH

NODE=M048R3;LINKAGE=AU

NODE=M048R3;LINKAGE=B

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_6

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.577±0.026±0.060	800	²⁷ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
²⁷ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.				

••• We do not use the following data for averages, fits, limits, etc. •••

NODE=M048R28

NODE=M048R28

NODE=M048R28;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.13 OUR AVERAGE				
2.24±0.09±0.11	6584	28 BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.99±0.34	56	29 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.2 ±0.4 ±0.3	33	30 HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

²⁸ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.
²⁹ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.
³⁰ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M048R11

NODE=M048R11

NODE=M048R11;LINKAGE=BH

NODE=M048R11;LINKAGE=B

NODE=M048R;LINKAGE=I

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.501±0.043	³¹ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

••• We do not use the following data for averages, fits, limits, etc. •••

³¹ Not independent of other values reported by BHARI 09.

NODE=M048R26

NODE=M048R26

NODE=M048R26;LINKAGE=BH

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	90	³² LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$
••• We do not use the following data for averages, fits, limits, etc. •••				
<0.8	90	^{32,33} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$
<0.18	90	³⁴ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$
<2.2	90	BROCK	91 CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

³² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.
³³ Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.
³⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R9

NODE=M048R9

NODE=M048R9;LINKAGE=LE

NODE=M048R9;LINKAGE=AU

NODE=M048R9;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_8/Γ_6

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<0.23	90	³⁵ LEES	11L BABR	$\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$
••• We do not use the following data for averages, fits, limits, etc. •••				
<1.9	90	³⁶ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

••• We do not use the following data for averages, fits, limits, etc. •••

³⁵ Not independent of other values reported by LEES 11L.
³⁶ Not independent of other values reported by AUBERT 08BP.

NODE=M048R27

NODE=M048R27

NODE=M048R27;LINKAGE=LE

NODE=M048R27;LINKAGE=AU

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.07	90	37 HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

³⁷ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R24
NODE=M048R24

NODE=M048R24;LINKAGE=HE

 $\Gamma(h_b(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 $\times 10^{-3}$	90	38 GE	11	CLEO $\Upsilon(3S) \rightarrow \pi^0$ anything

³⁸ Assuming $M(h_b(1P)) = 9900$ MeV and $\Gamma(h_b(1P)) = 0$ MeV, and allowing $B(h_b(1P) \rightarrow \gamma\eta_b(1S))$ to vary from 0–100%.

NODE=M048R03
NODE=M048R03

NODE=M048R03;LINKAGE=GE

 $\Gamma(h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.3 $\pm 1.1 \pm 0.9$	LEES	11K	BABR $\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M048R33
NODE=M048R33

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	39 LEES	11C	BABR $e^+e^- \rightarrow \pi^+\pi^-X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18 ³⁹ BUTLER 94B CLE2 $e^+e^- \rightarrow \pi^+\pi^-X$

<15 ³⁹ BROCK 91 CLEO $e^+e^- \rightarrow \pi^+\pi^-X$

³⁹ For $M(h_b(1P)) = 9900$ MeV.

NODE=M048R34
NODE=M048R34

NODE=M048R34;LINKAGE=MH

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.29 $\pm 0.21 \pm 0.22$	15k	40 BESSON 07	CLEO	$e^+e^- \rightarrow \Upsilon(3S) \rightarrow \tau^+\tau^-$

⁴⁰ BESSON 07 reports $[\Gamma(\Upsilon(3S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(3S) \rightarrow \mu^+\mu^-)] = 1.05 \pm 0.08 \pm 0.05$ which we multiply by our best value $B(\Upsilon(3S) \rightarrow \mu^+\mu^-) = (2.18 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M048R18
NODE=M048R18

NODE=M048R18;LINKAGE=BE

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_{13}/Γ_{14}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.968 ± 0.016 OUR AVERAGE				
0.966 $\pm 0.008 \pm 0.014$	2.2M	LEES	20E	BABR $e^+e^- \rightarrow \Upsilon(3S)$
1.05 $\pm 0.08 \pm 0.05$	15k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(3S)$

NODE=M048R19
NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0218 ± 0.0021 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.

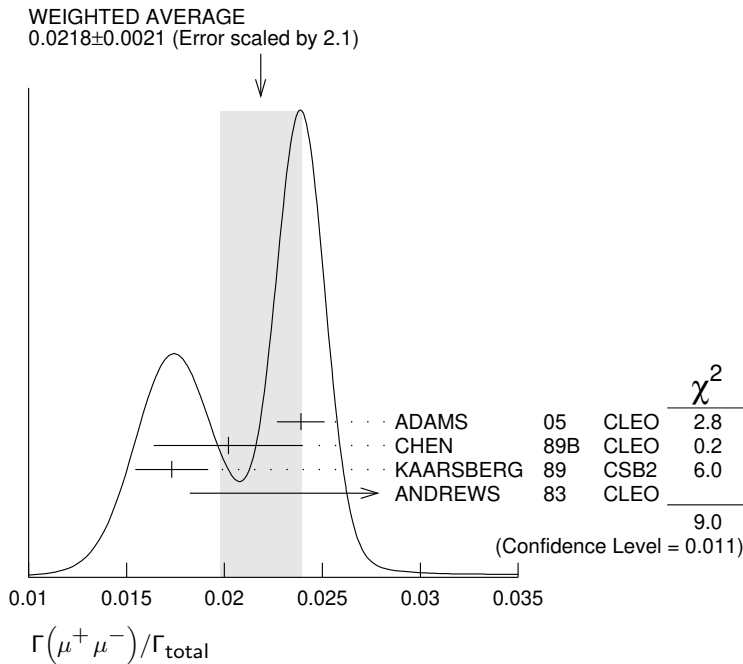
0.0239 $\pm 0.0007 \pm 0.0010$ 81k ADAMS 05 CLEO $e^+e^- \rightarrow \mu^+\mu^-$

0.0202 $\pm 0.0019 \pm 0.0033$ CHEN 89B CLEO $e^+e^- \rightarrow \mu^+\mu^-$

0.0173 $\pm 0.0015 \pm 0.0011$ KAARSBERG 89 CSB2 $e^+e^- \rightarrow \mu^+\mu^-$

0.033 $\pm 0.013 \pm 0.007$ 1096 ANDREWS 83 CLEO $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M048R1
NODE=M048R1



$\Gamma(g g g)/\Gamma_{total}$					Γ_{17}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
35.7±2.6	3M	⁴¹ BESSON	06A CLEO	$\Upsilon(3S) \rightarrow$ hadrons	

NODE=M048R30
NODE=M048R30

⁴¹ Calculated using BESSON 06A value of $\Gamma(\gamma g g)/\Gamma(g g g) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and the PDG 08 values of $B(\Upsilon(2S) + \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+ \pi^- \Upsilon(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0 \pi^0 \Upsilon(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma \chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma \chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma \chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+ \mu^-) = (2.18 \pm 0.21)\%$, and $R_{hadrons} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(\gamma g g)/\Gamma_{total}$ BESSON 06A value.

NODE=M048R30;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma_{total}$					Γ_{18}/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.97±0.18	60k	⁴² BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \gamma +$ hadrons	

NODE=M048R31
NODE=M048R31

⁴² Calculated using BESSON 06A values of $\Gamma(\gamma g g)/\Gamma(g g g) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and $\Gamma(g g g)/\Gamma_{total}$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(g g g)/\Gamma_{total}$ BESSON 06A value.

NODE=M048R31;LINKAGE=BE

$\Gamma(\gamma g g)/\Gamma(g g g)$					Γ_{18}/Γ_{17}
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.72±0.06±0.49	3M	BESSON	06A CLEO	$\Upsilon(3S) \rightarrow (\gamma +)$ hadrons	

NODE=M048R32
NODE=M048R32

$\Gamma(\overline{2H} \text{ anything})/\Gamma_{total}$					Γ_{19}/Γ
VALUE (units 10^{-5})		DOCUMENT ID	TECN	COMMENT	
2.33±0.15^{+0.31}_{-0.28}		LEES	14G BABR	$e^+ e^- \rightarrow \overline{2H} X$	

NODE=M048R00
NODE=M048R00

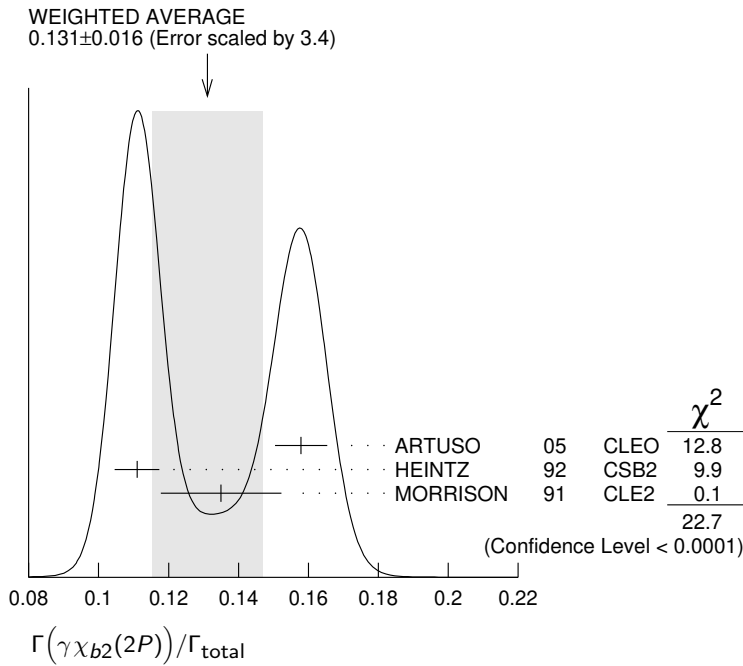
$\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{total}$					Γ_{20}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.131 ± 0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.			

NODE=M048R5
NODE=M048R5

0.1579±0.0017±0.0073	568k	ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$
0.111 ± 0.005 ± 0.004	10319	⁴³ HEINTZ	92	CSB2	$e^+ e^- \rightarrow \gamma X$
0.135 ± 0.003 ± 0.017	30741	MORRISON	91	CLE2	$e^+ e^- \rightarrow \gamma X$

⁴³ Supersedes NARAIN 91.

NODE=M048R;LINKAGE=H



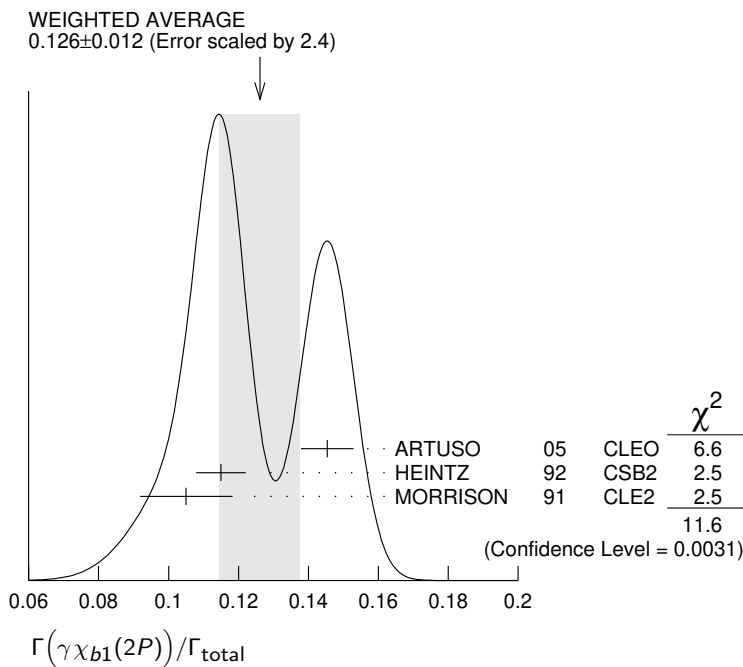
$\Gamma(\gamma\chi_{b1}(2P))/\Gamma_{total}$ **Γ_{21}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.126 ±0.012 OUR AVERAGE				Error includes scale factor of 2.4. See the ideogram below.
0.1454±0.0018±0.0073	537k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
0.115 ±0.005 ±0.005	11147	⁴⁴ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
0.105 ^{+0.003} _{-0.002} ±0.013	25759	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

NODE=M048R6
NODE=M048R6

⁴⁴Supersedes NARAIN 91.

NODE=M048R6;LINKAGE=H



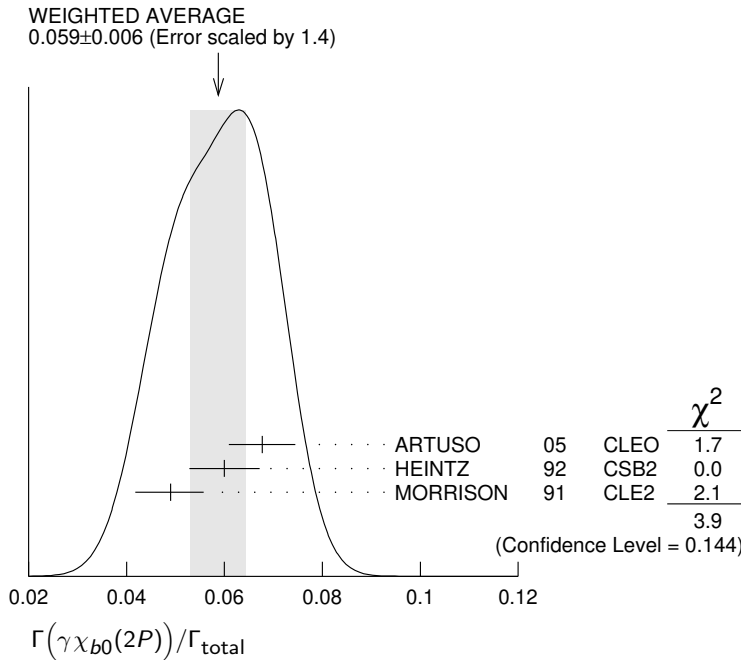
$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{total}$ **Γ_{22}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.059 ±0.006 OUR AVERAGE				Error includes scale factor of 1.4. See the ideogram below.
0.0677±0.0020±0.0065	225k	ARTUSO	05	CLEO $e^+e^- \rightarrow \gamma X$
0.060 ±0.004 ±0.006	4959	⁴⁵ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
0.049 ^{+0.003} _{-0.004} ±0.006	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

NODE=M048R7
NODE=M048R7

45 Supersedes NARAIN 91.

NODE=M048R7;LINKAGE=H



$\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{total}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
10.0±1.0 OUR AVERAGE			Error includes scale factor of 1.7.		
8.0±1.3±0.4		126	46,47 KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
10.5±0.3 ^{+0.7} _{-0.6}		9.7k	LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$

NODE=M048R21
NODE=M048R21

••• We do not use the following data for averages, fits, limits, etc. •••

<19	90	48	ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
seen		49	HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

46 Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$.

47 KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{total}] \times [B(\chi_{b2}(1P) \rightarrow \gamma\Upsilon(1S))]$
 $= (1.435 \pm 0.162 \pm 0.169) \times 10^{-3}$ which we divide by our best value $B(\chi_{b2}(1P) \rightarrow \gamma\Upsilon(1S)) = (18.0 \pm 1.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M048R21;LINKAGE=KA
NODE=M048R21;LINKAGE=KR

48 ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(1P))/\Gamma_{total}] / [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))]$
 $< 27.1 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

NODE=M048R21;LINKAGE=AS

49 HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma\Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0,1,2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1,2$ using $\Upsilon(1S) \rightarrow \ell^+\ell^-$.

NODE=M048R21;LINKAGE=HE

$\Gamma(\gamma\chi_{b1}(1P))/\Gamma_{total}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.5 OUR AVERAGE			Error includes scale factor of 1.8.		
1.5±0.4±0.1		50	50,51 KORNICER	11	CLEO $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
0.5±0.3 ^{+0.2} _{-0.1}			LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$

NODE=M048R22
NODE=M048R22

••• We do not use the following data for averages, fits, limits, etc. •••

<1.7	90	52	ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
seen		53	HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$

50 Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$.

51 KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(1P))/\Gamma_{total}] \times [B(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S))]$
 $= (5.38 \pm 1.20 \pm 0.95) \times 10^{-4}$ which we divide by our best value $B(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S)) = (35.2 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M048R22;LINKAGE=KA
NODE=M048R22;LINKAGE=KR

52 ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(1P))/\Gamma_{total}] / [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))] < 2.5 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M048R22;LINKAGE=AS

53 HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma\Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0,1,2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1,2$ using $\Upsilon(1S) \rightarrow \ell^+\ell^-$.

NODE=M048R22;LINKAGE=HE

$\Gamma(\gamma\chi_{b0}(1P))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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0.27±0.04 OUR AVERAGE0.27±0.04±0.02 2.3k LEES 11J BABR $\Upsilon(3S) \rightarrow X\gamma$ 0.30±0.04±0.10 8.7k ARTUSO 05 CLEO $e^+e^- \rightarrow \gamma X$

••• We do not use the following data for averages, fits, limits, etc. •••

<0.8 90 ⁵⁴ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

⁵⁴ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$
 $< 21.9 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M048R15
NODE=M048R15

NODE=M048R15;LINKAGE=AS

 $\Gamma(\gamma\eta_b(2S))/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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< 6.2 90 ARTUSO 05 CLEO $e^+e^- \rightarrow \gamma X$

••• We do not use the following data for averages, fits, limits, etc. •••

<19 90 LEES 11J BABR $\Upsilon(3S) \rightarrow X\gamma$ NODE=M048R16
NODE=M048R16 $\Gamma(\gamma\eta_b(1S))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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5.1±0.7 OUR AVERAGE7.1±1.8±1.3 2.3±0.5k ⁵⁵BONVICINI 10 CLEO $\Upsilon(3S) \rightarrow \gamma X$ 4.8±0.5±0.6 19±3k ⁵⁵AUBERT 09AQ BABR $\Upsilon(3S) \rightarrow \gamma X$

••• We do not use the following data for averages, fits, limits, etc. •••

<8.5 90 LEES 11J BABR $\Upsilon(3S) \rightarrow X\gamma$ 4.8±0.5±1.2 19±3k ^{55,56}AUBERT 08V BABR $\Upsilon(3S) \rightarrow \gamma X$ <4.3 90 ⁵⁷ARTUSO 05 CLEO $e^+e^- \rightarrow \gamma X$ ⁵⁵ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.⁵⁶ Systematic error re-evaluated by AUBERT 09AQ.⁵⁷ Superseded by BONVICINI 10.NODE=M048R17
NODE=M048R17NODE=M048R17;LINKAGE=BO
NODE=M048R17;LINKAGE=AU
NODE=M048R17;LINKAGE=SU $\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$ Γ_{28}/Γ (0.3 GeV < m_{A^0} < 7 GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<8 × 10⁻⁵ 90 ⁵⁸LEES 11H BABR $\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

⁵⁸ For a narrow scalar or pseudoscalar, A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M048R02

NODE=M048R02
NODE=M048R02

NODE=M048R02;LINKAGE=LE

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{29}/Γ (1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<2.2 95 ROSNER 07A CLEO $e^+e^- \rightarrow \gamma X$

NODE=M048R20

NODE=M048R20
NODE=M048R20 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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<5.5 90 ⁵⁹AUBERT 09Z BABR $e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$

⁵⁹ For a narrow scalar or pseudoscalar, A^0 , with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} range from 0.27–5.5 × 10⁻⁶.

NODE=M048R04
NODE=M048R04

NODE=M048R04;LINKAGE=AU

 $\Gamma(\gamma A^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<1.6 × 10⁻⁴ 90 ⁶⁰AUBERT 09P BABR $e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \tau^+ \tau^-$

⁶⁰ For a narrow scalar or pseudoscalar, A^0 , with $M(\tau^+ \tau^-)$ in the ranges 4.03–9.52 and 9.61–10.10 GeV. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from 1.5–16 × 10⁻⁵.

NODE=M048R29
NODE=M048R29

NODE=M048R29;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M048230

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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<4.2 90 LEES 10B BABR $e^+e^- \rightarrow e^\pm \tau^\mp$ NODE=M048R01
NODE=M048R01

$\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$					Γ_{33}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 3.6 \times 10^{-7}$	90	LEES	22A BABR	$e^+ e^- \rightarrow e^\pm \mu^\mp$	

NODE=M048R07
 NODE=M048R07

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$					Γ_{34}/Γ
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT	
< 3.1	90	LEES	10B BABR	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$	
< 20.3	95	LOVE	08A CLEO	$e^+ e^- \rightarrow \mu^\pm \tau^\mp$	

NODE=M048R23
 NODE=M048R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\Upsilon(3S)$ REFERENCES

NODE=M048

AAIJ	24AC	JHEP 2410 122	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63036
SHAMOV	23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
LEES	22A	PRL 128 091804	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61659
LEES	20E	PRL 125 241801	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=60700
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53937
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PR 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53062
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52262
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
BESSON	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799
WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)	REFID=43313
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)	REFID=41579
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)	REFID=41586
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=40919
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE $e^+ e^-$ Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
		Editors: A. Ali and P. Soeding, World Scientific, Singapore			
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
BARU	86B	ZPHY C32 622 (errata.)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
		Translated from YAF 41 733.			
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)	REFID=22273
GREEN	82	PRL 49 617	J. Green <i>et al.</i>	(CLEO Collab.)	REFID=22321
MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)	REFID=22359

$\chi_{b1}(3P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

Observed in the radiative decay to $\Upsilon(1S, 2S, 3S)$, therefore $C = +$.
 J needs confirmation.

NODE=M206

NODE=M206

 $\chi_{b1}(3P)$ MASS

NODE=M206M

NODE=M206M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10513.42 ± 0.41 ± 0.53		¹ SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
10515.7 + 2.2 + 1.5 - 3.9 - 2.1	169	² AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
10512.1 ± 2.1 ± 0.9	351	³ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
10511.3 ± 1.7 ± 2.5	182	⁴ AAIJ	14BI LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$
10530 ± 5 ± 9		⁵ AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$
10551 ± 14 ± 17		⁵ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$

OCCUR=2

NODE=M206M;LINKAGE=D

¹ Systematic error includes an additional 0.5 MeV for the uncertainty on the $\Upsilon(3S)$ mass. Also measures $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.60 \pm 0.64 \pm 0.17$ MeV. A total of 372 $\chi_{b1}(3P)$ and $\chi_{b2}(3P)$ events was observed.

NODE=M206M;LINKAGE=A

² From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206M;LINKAGE=B

³ The mass of the $\chi_{b1}(3P)$ state obtained by combining the results of AAIJ 14BG with that of AAIJ 14BI. The first uncertainty is experimental and the second attributable to the unknown mass splitting, assumed to be $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

NODE=M206M;LINKAGE=C

⁴ From $\chi_{b1}(3P) \rightarrow \Upsilon(3S)\gamma$ transition assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

NODE=M206M;LINKAGE=AA

⁵ The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.

 $\chi_{b1}(3P)$ DECAY MODES

NODE=M206215;NODE=M206

Mode	Fraction (Γ_i/Γ)
Γ_1 $\Upsilon(1S)\gamma$	seen
Γ_2 $\Upsilon(2S)\gamma$	seen
Γ_3 $\Upsilon(3S)\gamma$	seen

DESIG=1

DESIG=2

DESIG=3

 $\chi_{b1}(3P)$ BRANCHING RATIOS

NODE=M206225

$\Gamma(\Upsilon(1S)\gamma)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	169	¹ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
seen		AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
seen		ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M206R01
NODE=M206R01

¹ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	169	¹ AAIJ	14BG LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
seen		AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M206R02
NODE=M206R02

¹ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206R02;LINKAGE=A

$\Gamma(\Upsilon(3S)\gamma)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
seen		SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
seen	182	AAIJ	14BI LHCB	$pp \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M206R03
NODE=M206R03

$\chi_{b1}(3P)$ REFERENCES

SIRUNYAN	18N	PRL 121 092002	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BI	EPJ C74 3092	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ABAZOV	12Q	PR D86 031103	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M206

REFID=58873
REFID=56199
REFID=56235
REFID=54037
REFID=54264 **$\chi_{b2}(3P)$**

$$I^G(J^{PC}) = 0^+(2^{++})$$

Observed in the radiative decay to $\Upsilon(3S)$, therefore $C = +$. J needs confirmation.

NODE=M238

NODE=M238

 $\chi_{b2}(3P)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10524.02 ± 0.57 ± 0.53	¹ SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10530 ± 5 ± 9	² AAD	12A ATLS	$pp \rightarrow \gamma \mu^+ \mu^- X$

NODE=M238M

NODE=M238M

¹ Systematic error includes an additional 0.5 MeV for the uncertainty on the $\Upsilon(3S)$ mass. Also measures $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.60 \pm 0.64 \pm 0.17$ MeV. A total of 372 $\chi_{b1}(3P)$ and $\chi_{b2}(3P)$ events was observed.

NODE=M238M;LINKAGE=A

² The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.

NODE=M238M;LINKAGE=AA

 $\chi_{b2}(3P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(3S)\gamma$	seen

NODE=M238215;NODE=M238

DESIG=1

 $\chi_{b2}(3P)$ BRANCHING RATIOS

$\Gamma(\Upsilon(3S)\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M238225

NODE=M238R01
NODE=M238R01 **$\chi_{b2}(3P)$ REFERENCES**

SIRUNYAN	18N	PRL 121 092002	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)

NODE=M238

REFID=58873
REFID=54037

$\Upsilon(4S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $\Upsilon(10580)$

NODE=M047

 $\Upsilon(4S)$ MASS

NODE=M047M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10579.4±1.2 OUR AVERAGE			
10579.3±0.4±1.2	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
10580.0±3.5	¹ BEBEK	87 CLEO	$e^+e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10577.4±1.0	² LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons
¹ Reanalysis of BESSON 85.			
² No systematic error given.			

NODE=M047M

NODE=M047M;LINKAGE=C
NODE=M047M;LINKAGE=B **$\Upsilon(4S)$ WIDTH**

NODE=M047W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
20.5±2.5 OUR AVERAGE			
20.7±1.6±2.5	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
20 ±2 ±4	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
25 ±2.5	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M047W

 $\Upsilon(4S)$ DECAY MODES

NODE=M047215;NODE=M047

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}$	> 96 %	95%
Γ_2 B^+B^-	(51.4 ±0.6) %	
Γ_3 D^+ anything + c.c.	(17.8 ±2.6) %	
Γ_4 $B^0\bar{B}^0$	(48.6 ±0.6) %	
Γ_5 $J/\psi K_S^0 + (J/\psi, \eta_c) K_S^0$	< 4 × 10 ⁻⁷	90%
Γ_6 non- $B\bar{B}$	< 4 %	95%
Γ_7 e^+e^-	(1.57±0.08) × 10 ⁻⁵	
Γ_8 $\rho^+\rho^-$	< 5.7 × 10 ⁻⁶	90%
Γ_9 $K^*(892)^0\bar{K}^0$	< 2.0 × 10 ⁻⁶	90%
Γ_{10} $J/\psi(1S)$ anything	< 1.9 × 10 ⁻⁴	95%
Γ_{11} D^{*+} anything + c.c.	< 7.4 %	90%
Γ_{12} ϕ anything	(7.1 ±0.6) %	
Γ_{13} $\phi\eta$	< 1.8 × 10 ⁻⁶	90%
Γ_{14} $\phi\eta'$	< 4.3 × 10 ⁻⁶	90%
Γ_{15} $\rho\eta$	< 1.3 × 10 ⁻⁶	90%
Γ_{16} $\rho\eta'$	< 2.5 × 10 ⁻⁶	90%
Γ_{17} $\Upsilon(1S)$ anything	< 4 × 10 ⁻³	90%
Γ_{18} $\Upsilon(1S)\pi^+\pi^-$	(8.2 ±0.4) × 10 ⁻⁵	
Γ_{19} $\Upsilon(1S)\eta$	(1.81±0.18) × 10 ⁻⁴	
Γ_{20} $\Upsilon(1S)\eta'$	(3.4 ±0.9) × 10 ⁻⁵	
Γ_{21} $\Upsilon(2S)\pi^+\pi^-$	(8.2 ±0.8) × 10 ⁻⁵	
Γ_{22} $h_b(1P)\pi^+\pi^-$	not seen	
Γ_{23} $h_b(1P)\eta$	(2.18±0.21) × 10 ⁻³	
Γ_{24} $\eta_b(1S)\omega$	< 1.8 × 10 ⁻⁴	90%
Γ_{25} 2H anything	< 1.3 × 10 ⁻⁵	90%

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=10

DESIG=12

DESIG=11

DESIG=15

DESIG=6

DESIG=1

DESIG=16

DESIG=22

DESIG=2

DESIG=3

DESIG=4

DESIG=13

DESIG=18

DESIG=19

DESIG=20

DESIG=5

DESIG=7

DESIG=17

DESIG=26

DESIG=9

DESIG=21

DESIG=23

DESIG=27

DESIG=14

Double Radiative Decays

Γ_{26} $\gamma\gamma\Upsilon(D) \rightarrow \gamma\gamma\eta\Upsilon(1S)$	< 2.3 × 10 ⁻⁵	90%
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NODE=M047;CLUMP=B

DESIG=24

$\Upsilon(4S)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$

Γ_7

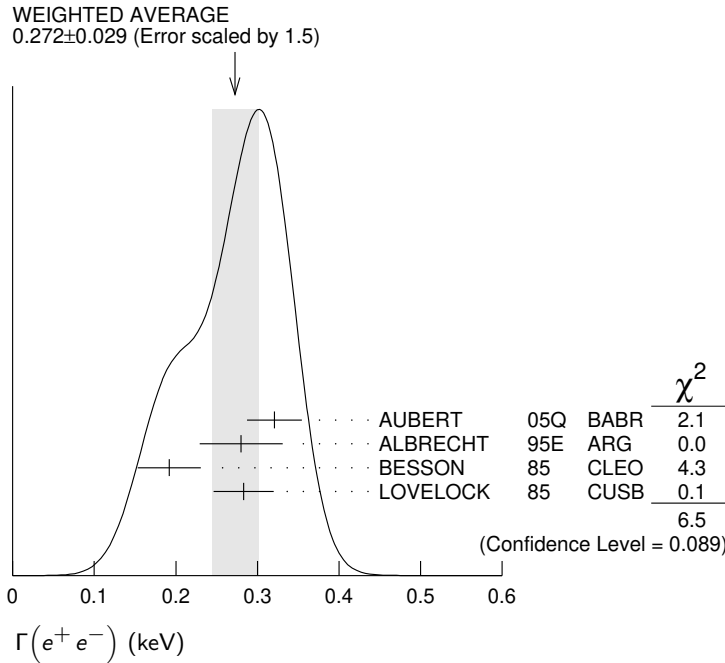
VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.272 ± 0.029 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
0.321 ± 0.017 ± 0.029	AUBERT	05Q	BABR $e^+e^- \rightarrow$ hadrons
0.28 ± 0.05 ± 0.01	¹ ALBRECHT	95E	ARG $e^+e^- \rightarrow$ hadrons
0.192 ± 0.007 ± 0.038	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons
0.283 ± 0.037	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons

¹Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

NODE=M047220

NODE=M047W1
NODE=M047W1

NODE=M047W1;LINKAGE=A



$\Upsilon(4S)$ BRANCHING RATIOS

———— $B\bar{B}$ DECAYS ————

The ratio of branching fraction to charged and neutral B mesons is often derived assuming isospin invariance in the decays, and relies on the knowledge of the B^+/B^0 lifetime ratio. "OUR EVALUATION" is obtained based on averages of rescaled data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>. The averaging/rescaling procedure takes into account the common dependence of the measurement on the value of the lifetime ratio.

NODE=M047230

NODE=M047BBD

NODE=M047BBD

$\Gamma(B^+B^-)/\Gamma_{total}$

Γ_2/Γ

VALUE	DOCUMENT ID	COMMENT
0.514 ± 0.006 OUR EVALUATION	(Produced by HFLAV) Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$	

NODE=M047R11
NODE=M047R11
→ UNCHECKED ←

$\Gamma(D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{total}$

Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.178 ± 0.021 ± 0.016	¹ ARTUSO	05B	CLE3 $e^+e^- \rightarrow D_s^+ X$

NODE=M047R13
NODE=M047R13

¹ARTUSO 05B reports $[\Gamma(\Upsilon(4S) \rightarrow D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{total}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = (8.0 \pm 0.2 \pm 0.9) \times 10^{-3}$ which we divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R13;LINKAGE=AR

$\Gamma(B^0\bar{B}^0)/\Gamma_{total}$

Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.486 ± 0.006 OUR EVALUATION	Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$		

NODE=M047R12
NODE=M047R12
→ UNCHECKED ←

••• We do not use the following data for averages, fits, limits, etc. •••
0.487 ± 0.010 ± 0.008 ¹AUBERT,B 05H BABR $\Upsilon(4S) \rightarrow \bar{B}B \rightarrow D^* \ell \nu_\ell$

¹ Direct measurement. This value is averaged with the value extracted from the $\Gamma(B^+ B^-) / \Gamma(B^0 \bar{B}^0)$ measurements.

NODE=M047R12;LINKAGE=AU

 $\Gamma(B^+ B^-) / \Gamma(B^0 \bar{B}^0)$ Γ_2 / Γ_4

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.058 ± 0.024 OUR EVALUATION				
1.065 ± 0.012 ± 0.051		¹ CHOUDHURY 23	BELL	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.006 ± 0.036 ± 0.031		² AUBERT 04F	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.01 ± 0.03 ± 0.09		² HASTINGS 03	BELL	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow \text{dileptons}$
1.058 ± 0.084 ± 0.136		³ ATHAR 02	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow D^* \ell \nu$
1.10 ± 0.06 ± 0.05		⁴ AUBERT 02	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow (c\bar{c}) K^*$
1.04 ± 0.07 ± 0.04		⁵ ALEXANDER 01	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

NODE=M047R10
 NODE=M047R10
 → UNCHECKED ←

¹ CHOUDHURY 23 includes uncertainty due to the isospin symmetry assumption in $B \rightarrow J/\psi K$ decays.

NODE=M047R10;LINKAGE=A

² HASTINGS 03 and AUBERT 04F assume $\tau(B^+) / \tau(B^0) = 1.083 \pm 0.017$.

NODE=M047R10;LINKAGE=F

³ ATHAR 02 assumes $\tau(B^+) / \tau(B^0) = 1.074 \pm 0.028$. Supersedes BARISH 95.

NODE=M047R10;LINKAGE=D

⁴ AUBERT 02 assumes $\tau(B^+) / \tau(B^0) = 1.062 \pm 0.029$.

NODE=M047R10;LINKAGE=E

⁵ ALEXANDER 01 assumes $\tau(B^+) / \tau(B^0) = 1.066 \pm 0.024$.

NODE=M047R10;LINKAGE=C

 $[\Gamma(J/\psi K_S^0) + \Gamma((J/\psi, \eta_c) K_S^0)] / \Gamma_{\text{total}}$ Γ_5 / Γ

Forbidden by CP invariance.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹ TAJIMA 07A	BELL	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0$

NODE=M047R16
 NODE=M047R16
 NODE=M047R16

¹ $\Upsilon(4S)$ with CP = +1 decays to the final state with CP = -1.

NODE=M047R16;LINKAGE=TA

non- $B\bar{B}$ DECAYS

NODE=M047NBB

 $\Gamma(\text{non-}B\bar{B}) / \Gamma_{\text{total}}$ Γ_6 / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	95	BARISH 96B	CLEO	$e^+ e^-$

NODE=M047R6
 NODE=M047R6

 $\Gamma(e^+ e^-) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.57 ± 0.08 OUR AVERAGE				
1.55 ± 0.04 ± 0.07		AUBERT 05Q	BABR	$e^+ e^- \rightarrow \text{hadrons}$
2.77 ± 0.50 ± 0.49		¹ ALBRECHT 95E	ARG	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M047R5
 NODE=M047R5

¹ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.

NODE=M047R5;LINKAGE=A

 $\Gamma(\rho^+ \rho^-) / \Gamma_{\text{total}}$ Γ_8 / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.7 × 10⁻⁶	90	AUBERT 08BO	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- 2\pi^0$

NODE=M047R17
 NODE=M047R17

 $\Gamma(K^*(892)^0 \bar{K}^0) / \Gamma_{\text{total}}$ Γ_9 / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0 × 10⁻⁶	90	SHEN 13A	BELL	$e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M047R02
 NODE=M047R02

 $\Gamma(J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}}$ Γ_{10} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	95	¹ ABE 02D	BELL	$e^+ e^- \rightarrow J/\psi X \rightarrow \ell^+ \ell^- X$

NODE=M047R1
 NODE=M047R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.7	90	¹ AUBERT 01C	BABR	$e^+ e^- \rightarrow J/\psi X \rightarrow \ell^+ \ell^- X$
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¹ Uses $B(J/\psi \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

NODE=M047R;LINKAGE=AC

 $\Gamma(D^{*+} \text{ anything} + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{11} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.074	90	¹ ALEXANDER 90C	CLEO	$e^+ e^-$

NODE=M047R2
 NODE=M047R2

¹ For $x > 0.473$.

NODE=M047R2;LINKAGE=A

 $\Gamma(\phi \text{ anything}) / \Gamma_{\text{total}}$ Γ_{12} / Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
7.1 ± 0.1 ± 0.6		HUANG 07	CLEO	$\Upsilon(4S) \rightarrow \phi X$

NODE=M047R3
 NODE=M047R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.23	90	¹ ALEXANDER 90C	CLEO	$e^+ e^-$
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¹ For $x > 0.52$.

NODE=M047R3;LINKAGE=A

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \phi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.5	90	AUBERT, BE 06F	BABR	$e^+e^- \rightarrow \phi\eta$
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¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R14
NODE=M047R14

NODE=M047R14;LINKAGE=BE

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.3	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \phi\eta'$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R21
NODE=M047R21

NODE=M047R21;LINKAGE=BE

 $\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \rho\eta$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R22
NODE=M047R22

NODE=M047R22;LINKAGE=BE

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \rho\eta'$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R23
NODE=M047R23

NODE=M047R23;LINKAGE=BE

 $\Gamma(\Upsilon(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.004	90	ALEXANDER 90C	CLEO	e^+e^-

NODE=M047R4
NODE=M047R4

 $\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.2 ± 0.4 OUR AVERAGE					

8.2 ± 0.5 ± 0.4		515	GUIDO 17	BELL	$\Upsilon(4S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
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8.5 ± 1.3 ± 0.1		113 ± 16	¹ SOKOLOV 09	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
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8.00 ± 0.64 ± 0.27		430	² AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

17.8 ± 4.0 ± 0.3			^{3,4} SOKOLOV 07	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
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9.0 ± 1.5 ± 0.2		167 ± 19	⁵ AUBERT 06R	BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
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<12		90	GLENN 99	CLE2	e^+e^-
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¹ SOKOLOV 09 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (0.211 \pm 0.030 \pm 0.014) \times 10^{-5}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³ SOKOLOV 07 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (4.42 \pm 0.81 \pm 0.56) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ According to the authors, systematic errors were underestimated.

⁵ Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (2.23 \pm 0.25 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7
NODE=M047R7

NODE=M047R7;LINKAGE=SK

NODE=M047R7;LINKAGE=UB

NODE=M047R7;LINKAGE=SO

NODE=M047R7;LINKAGE=US

NODE=M047R7;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.81 ± 0.18 OUR AVERAGE					

1.70 ± 0.23 ± 0.08		49	GUIDO 17	BELL	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\mu^+\mu^-$
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1.96 ± 0.26 ± 0.09		56	¹ AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\ell^+\ell^-$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.7		90	² TAMPONI 15	BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
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¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

NODE=M047R18
NODE=M047R18

NODE=M047R18;LINKAGE=UB

NODE=M047R18;LINKAGE=A

$\Gamma(\Upsilon(1S)\eta')/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.43±0.88±0.21	27	GUIDO	18	BELL $\Upsilon(4S) \rightarrow (\rho^0 \gamma, \pi^+ \pi^- \eta) \mu^+ \mu^-$

NODE=M047R03
 NODE=M047R03

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{18}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M047R19
 NODE=M047R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.41±0.40±0.12 56 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- (\pi^0) \ell^+ \ell^-$

¹ Not independent of other values reported by AUBERT 08BP.

NODE=M047R19;LINKAGE=UB

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.2±0.8 OUR AVERAGE					

NODE=M047R9
 NODE=M047R9

7.9±1.0±0.4 181 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$

8.6±1.1±0.7 220 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.8±1.7±0.8 97 ± 15 ² AUBERT 06R BABR $e^+ e^- \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
 <3.9 90 GLENN 99 CLE2 $e^+ e^-$

¹ Using $B(\Upsilon(2S) \rightarrow e^+ e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

NODE=M047R9;LINKAGE=UB

² Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \mu^+ \mu^-)] = (1.69 \pm 0.26 \pm 0.20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R9;LINKAGE=AU

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{21}/Γ_{18}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M047R20
 NODE=M047R20

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.16±0.16±0.14 220 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

¹ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+ e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M047R20;LINKAGE=UB

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M047R01
 NODE=M047R01

not seen $(35^{+32}_{-26})k$ ¹ ADACHI 12 BELL $10.58 e^+ e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹ From the upper limit on the ratio of $\sigma(e^+ e^- \rightarrow h_b(1P)\pi^+\pi^-)$ at the $\Upsilon(4S)$ to that at the $\Upsilon(5S)$ of 0.27.

NODE=M047R01;LINKAGE=AD

 $\Gamma(h_b(1P)\eta)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M047R00
 NODE=M047R00

2.18±0.11±0.18 112k ¹ TAMPONI 15 BELL $e^+ e^- \rightarrow h_b(1P)\eta$

¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

NODE=M047R00;LINKAGE=A

 $\Gamma(\eta_b(1S)\omega)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M047R04
 NODE=M047R04

<**1.8 × 10⁻⁴** 90 OSKIN 20 BELL $e^+ e^- \rightarrow \omega X$

 $\Gamma(\eta_b(1S)\omega)/\Gamma(h_b(1P)\eta)$ Γ_{24}/Γ_{23}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M047R05
 NODE=M047R05

<**8.4 × 10⁻²** 90 ¹ OSKIN 20 BELL $e^+ e^- \rightarrow \omega X$

¹ Using $B(\Upsilon(4S) \rightarrow h_b(1P)\eta) = (2.18 \pm 0.11 \pm 0.18) \times 10^{-3}$ from TAMPONI 15.

NODE=M047R05;LINKAGE=A

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M047R15
 NODE=M047R15

<**1.3** 90 ASNER 07 CLEO $e^+ e^- \rightarrow \overline{d} X$

————— Double Radiative Decays —————

NODE=M047240

 $\Gamma(\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M047R24
 NODE=M047R24

<**2.3 × 10⁻⁵** 90 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \gamma\gamma\pi^+\pi^-\pi^0\mu^+\mu^-$

$\Upsilon(4S)$ REFERENCES

NODE=M047

CHOUDHURY	23	PR D107 L031102	S. Choudhury <i>et al.</i>	(BELLE Collab.)	REFID=62074
OSKIN	20	PR D102 092011	P. Oskin <i>et al.</i>	(BELLE Collab.)	REFID=60735
GUIDO	18	PRL 121 062001	E. Guido <i>et al.</i>	(BELLE Collab.)	REFID=58860
GUIDO	17	PR D96 052005	E. Guido <i>et al.</i>	(BELLE Collab.)	REFID=58218
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=56996
SHEN	13A	PR D88 052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55591
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)	REFID=53962
BELOUS	09	PL B681 400	K. Belous <i>et al.</i>	(BELLE Collab.)	REFID=53107
SOKOLOV	09	PR D79 051103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=52760
AUBERT	08BO	PR D78 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52659
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=51624
SOKOLOV	07	PR D75 071103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=51715
TAJIMA	07A	PRL 99 231601	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=52066
AUBERT	06R	PRL 96 232001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51143
AUBERT,BE	06F	PR D74 111103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51563
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50992
AUBERT	05Q	PR D72 032005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50774
AUBERT,B	05H	PRL 95 042001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50777
AUBERT	04F	PR D69 071101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49748
HASTINGS	03	PR D67 052004	N.C. Hastings <i>et al.</i>	(BELLE Collab.)	REFID=49209
ABE	02D	PRL 88 052001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=48557
ATHAR	02	PR D66 052003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=48832
AUBERT	02	PR D65 032001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48514
ALEXANDER	01	PRL 86 2737	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48316
AUBERT	01C	PRL 87 162002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48346
GLENN	99	PR D59 052003	S. Glenn <i>et al.</i>		REFID=46890
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44693
ALBRECHT	95E	ZPHY C65 619	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44372
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44139
ALEXANDER	90C	PRL 64 2226	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=41346
BEBEK	87	PR D36 1289	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=40270
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22368
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)	REFID=22369
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)	REFID=44695

NODE=M243

 $\Upsilon(10753)$

$$I^G(J^{PC}) = ?(1^{--})$$

OMITTED FROM SUMMARY TABLE

A candidate for $\Upsilon(3D)$ state or an exotic structure.

NODE=M243

Seen by MIZUK 19 in $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ($n=1,2,3$) with a significance of 5.2σ . $\Upsilon(10753)$ MASS

NODE=M243M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$10752.7 \pm 5.9^{+0.7}_{-1.1}$	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

NODE=M243M

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

10761 ± 2	² DONG	20A	$e^+e^- \rightarrow b\bar{b}$
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¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M243M;LINKAGE=A

² From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M243M;LINKAGE=B

 $\Upsilon(10753)$ WIDTH

NODE=M243W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$35.5^{+17.6+3.9}_{-11.3-3.3}$	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

NODE=M243W

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

48.5 ± 3.0	² DONG	20A	$e^+e^- \rightarrow b\bar{b}$
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¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M243W;LINKAGE=A

² From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M243W;LINKAGE=B

$\Upsilon(10753)$ DECAY MODES

NODE=M243215;NODE=M243

Mode	
Γ_1	$\Upsilon(1S)\pi^+\pi^-$
Γ_2	$\Upsilon(2S)\pi^+\pi^-$
Γ_3	$\Upsilon(3S)\pi^+\pi^-$
Γ_4	$\omega\chi_{b1}(1P)$
Γ_5	$\omega\chi_{b2}(1P)$
Γ_6	e^+e^-

DESIG=3
DESIG=4
DESIG=5
DESIG=6
DESIG=7
DESIG=2

 $\Upsilon(10753) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M243225

 $\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M243R00
NODE=M243R00

••• We do not use the following data for averages, fits, limits, etc. •••

0.295±0.175	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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NODE=M243R00;LINKAGE=A

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.12–0.47 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R00;LINKAGE=B

 $\Gamma(\Upsilon(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_2\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M243R02
NODE=M243R02

••• We do not use the following data for averages, fits, limits, etc. •••

0.875±0.345	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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NODE=M243R02;LINKAGE=A

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.53–1.22 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R02;LINKAGE=B

 $\Gamma(\Upsilon(3S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_3\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M243R03
NODE=M243R03

••• We do not use the following data for averages, fits, limits, etc. •••

0.235±0.025	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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NODE=M243R03;LINKAGE=A

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.21–0.26 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R03;LINKAGE=B

 $\Gamma(\omega\chi_{b1}(1P)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_4\Gamma_6/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M243R05
NODE=M243R05

0.63±0.39±0.20	68	¹ ADACHI	23	BELL $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$
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NODE=M243R05;LINKAGE=A

¹ A fit solution with constructive interference. The other solution corresponding to destructive interference gives a value of $2.01 \pm 0.38 \pm 0.76$ eV.

 $\Gamma(\omega\chi_{b2}(1P)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_5\Gamma_6/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M243R06
NODE=M243R06

0.53±0.46±0.15	68	¹ ADACHI	23	BELL $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$
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NODE=M243R06;LINKAGE=A

¹ A fit solution with constructive interference. The other solution corresponding to destructive interference gives a value of $1.32 \pm 0.44 \pm 0.55$ eV.

 $\Upsilon(10753)$ REFERENCES

NODE=M243

ADACHI	23	PRL 130 091902	I. Adachi <i>et al.</i>	(BELLE II Collab.)
DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>	
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=62210
REFID=60595
REFID=60090
REFID=57121
REFID=52661

$\Upsilon(10860)$

$$J^{PC} = 0^{-}(1^{-})^{-}$$

NODE=M092

 $\Upsilon(10860)$ MASS

NODE=M092M

NODE=M092M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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10885.2^{+2.6}_{-1.6} OUR AVERAGE

10885.3 \pm 1.5 ^{+2.2} _{-0.9}	1 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
10884.7 \pm 3.6 ^{+8.9} _{-3.4-1.0}	2 MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P,2P)\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10882 \pm 1	3 DONG	20A	$e^+e^- \rightarrow b\bar{b}$
10881.8 \pm 1.0 ^{+1.0} _{-1.1} \pm 1.2	4,5 SANTEL	16	BELL $e^+e^- \rightarrow$ hadrons
10891.1 \pm 3.2 ^{+1.2} _{-2.0}	6,7 SANTEL	16	BELL $e^+e^- \rightarrow \Upsilon(1S,2S,3S)\pi^+\pi^-$
10879 \pm 3	8,9 CHEN	10	BELL $e^+e^- \rightarrow$ hadrons
10888.4 \pm 2.7 ^{+1.2} _{-2.6}	10 CHEN	10	BELL $e^+e^- \rightarrow \Upsilon(1S,2S,3S)\pi^+\pi^-$
10876 \pm 2	8 AUBERT	09E	BABR $e^+e^- \rightarrow$ hadrons
10869 \pm 2	11 AUBERT	09E	BABR $e^+e^- \rightarrow$ hadrons
10868 \pm 6 \pm 5	12 BESSON	85	CLEO $e^+e^- \rightarrow$ hadrons
10845 \pm 20	13 LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons

OCCUR=2

OCCUR=2

OCCUR=2

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6$ –11.05 GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092M;LINKAGE=E

² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77$ –11.02 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M092M;LINKAGE=D

³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M092M;LINKAGE=H

⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82$ –11.05 GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M092M;LINKAGE=A

⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

NODE=M092M;LINKAGE=B

⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6$ –11.05 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M092M;LINKAGE=C

⁷ Superseded by MIZUK 19.

NODE=M092M;LINKAGE=F

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M092M;LINKAGE=AU

⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

NODE=M092M;LINKAGE=CH

¹⁰ In a model where a flat nonresonant $\Upsilon(1S,2S,3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

NODE=M092M;LINKAGE=CE

¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

NODE=M092M;LINKAGE=UB

¹² Assuming four Gaussians with radiative tails and a single step in R .

NODE=M092M;LINKAGE=BE

¹³ In a coupled-channel model with three resonances and a smooth step in R .

NODE=M092M;LINKAGE=LO

 $\Upsilon(10860)$ WIDTH

NODE=M092W

NODE=M092W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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37 \pm 4 OUR AVERAGE

36.6 \pm 4.5 ^{+0.5} _{-3.9-1.1}	1 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
40.6 \pm 12.7 ^{+1.1} _{-8.0-19.1}	2 MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P,2P)\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

49.5 ± 1.5	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$	
48.5 ^{+1.9+2.0} _{-1.8-2.8}	4,5 SANTEL	16 BELL	$e^+e^- \rightarrow \text{hadrons}$	
53.7 ^{+7.1+1.3} _{-5.6-5.4}	6,7 SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$	OCCUR=2
46 ⁺⁹ ₋₇	8,9 CHEN	10 BELL	$e^+e^- \rightarrow \text{hadrons}$	
30.7 ^{+8.3} _{-7.0} ± 3.1	¹⁰ CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$	OCCUR=2
43 ± 4	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$	
74 ± 4	¹¹ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$	OCCUR=2
112 ± 17 ± 23	¹² BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$	
110 ± 15	¹³ LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$	
¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.				NODE=M092W;LINKAGE=F
² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.				NODE=M092W;LINKAGE=D
³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.				NODE=M092W;LINKAGE=G
⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).				NODE=M092W;LINKAGE=A
⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.				NODE=M092W;LINKAGE=B
⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.				NODE=M092W;LINKAGE=C
⁷ Superseded by MIZUK 19.				NODE=M092W;LINKAGE=E
⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.				NODE=M092W;LINKAGE=AU
⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.				NODE=M092W;LINKAGE=CH
¹⁰ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.				NODE=M092W;LINKAGE=CE
¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.				NODE=M092W;LINKAGE=UB
¹² Assuming four Gaussians with radiative tails and a single step in R .				NODE=M092W;LINKAGE=BE
¹³ In a coupled-channel model with three resonances and a smooth step in R .				NODE=M092W;LINKAGE=LO

$\Upsilon(10860)$ DECAY MODES

NODE=M092215;NODE=M092

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $B\bar{B}X$	(76.2 ^{+2.7} _{-4.0}) %		DESIG=9
Γ_2 $B\bar{B}$	(5.5 ± 1.0) %		DESIG=2
Γ_3 $B\bar{B}^* + \text{c.c.}$	(13.7 ± 1.6) %		DESIG=3
Γ_4 $B^*\bar{B}^*$	(38.1 ± 3.4) %		DESIG=4
Γ_5 $B\bar{B}^{(*)}\pi$	< 19.7 %	90%	DESIG=10
Γ_6 $B\bar{B}\pi$	(0.0 ± 1.2) %		DESIG=23
Γ_7 $B^*\bar{B}\pi + B\bar{B}^*\pi$	(7.3 ± 2.3) %		DESIG=24
Γ_8 $B^*\bar{B}^*\pi$	(1.0 ± 1.4) %		DESIG=25
Γ_9 $B\bar{B}\pi\pi$	< 8.9 %	90%	DESIG=11
Γ_{10} $B_s^{(*)}\bar{B}_s^{(*)}$	(20.1 ± 3.1) %		DESIG=16
Γ_{11} $B_s\bar{B}_s$	(5 ± 5) × 10 ⁻³		DESIG=5
Γ_{12} $B_s\bar{B}_s^* + \text{c.c.}$	(1.35 ± 0.32) %		DESIG=7
Γ_{13} $B_s^*\bar{B}_s^*$	(17.6 ± 2.7) %		DESIG=8
Γ_{14} no open-bottom	(3.8 ^{+5.0} _{-0.5}) %		DESIG=28

Γ_{15}	$e^+ e^-$	$(8.3 \pm 2.1) \times 10^{-6}$		DESIG=1
Γ_{16}	$K^*(892)^0 \bar{K}^0$	$< 1.0 \times 10^{-5}$	90%	DESIG=29
Γ_{17}	$\Upsilon(1S) \pi^+ \pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$		DESIG=17
Γ_{18}	$\Upsilon(1S) \eta$	$(8.5 \pm 1.7) \times 10^{-4}$		DESIG=44
Γ_{19}	$\Upsilon(1S) \eta'$	$< 6.9 \times 10^{-5}$	90%	DESIG=45
Γ_{20}	$\Upsilon(2S) \pi^+ \pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$		DESIG=18
Γ_{21}	$\Upsilon(2S) \eta$	$(4.1 \pm 0.6) \times 10^{-3}$		DESIG=46
Γ_{22}	$\Upsilon(3S) \pi^+ \pi^-$	$(4.8 \begin{smallmatrix} +1.9 \\ -1.7 \end{smallmatrix}) \times 10^{-3}$		DESIG=19
Γ_{23}	$\Upsilon(1S) K^+ K^-$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=20
Γ_{24}	$\eta \Upsilon_J(1D)$	$(4.8 \pm 1.1) \times 10^{-3}$		DESIG=40
Γ_{25}	$h_b(1P) \pi^+ \pi^-$	$(3.5 \begin{smallmatrix} +1.0 \\ -1.3 \end{smallmatrix}) \times 10^{-3}$		DESIG=26
Γ_{26}	$h_b(2P) \pi^+ \pi^-$	$(5.7 \begin{smallmatrix} +1.7 \\ -2.1 \end{smallmatrix}) \times 10^{-3}$		DESIG=27
Γ_{27}	$\chi_{bJ}(1P) \pi^+ \pi^- \pi^0$	$(2.5 \pm 2.3) \times 10^{-3}$		DESIG=41
Γ_{28}	$\chi_{b0}(1P) \pi^+ \pi^- \pi^0$	$< 6.3 \times 10^{-3}$	90%	DESIG=30
Γ_{29}	$\chi_{b0}(1P) \omega$	$< 3.9 \times 10^{-3}$	90%	DESIG=31
Γ_{30}	$\chi_{b0}(1P) (\pi^+ \pi^- \pi^0)_{\text{non-}\omega}$	$< 4.8 \times 10^{-3}$	90%	DESIG=32
Γ_{31}	$\chi_{b1}(1P) \pi^+ \pi^- \pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$		DESIG=33
Γ_{32}	$\chi_{b1}(1P) \omega$	$(1.57 \pm 0.30) \times 10^{-3}$		DESIG=34
Γ_{33}	$\chi_{b1}(1P) (\pi^+ \pi^- \pi^0)_{\text{non-}\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$		DESIG=35
Γ_{34}	$\chi_{b2}(1P) \pi^+ \pi^- \pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$		DESIG=36
Γ_{35}	$\chi_{b2}(1P) \omega$	$(6.0 \pm 2.7) \times 10^{-4}$		DESIG=37
Γ_{36}	$\chi_{b2}(1P) (\pi^+ \pi^- \pi^0)_{\text{non-}\omega}$	$(6 \pm 4) \times 10^{-4}$		DESIG=38
Γ_{37}	$\gamma X_b \rightarrow \gamma \Upsilon(1S) \omega$	$< 3.8 \times 10^{-5}$	90%	DESIG=39
Γ_{38}	$\eta_b(1S) \omega$	$< 1.3 \times 10^{-3}$	90%	DESIG=42
Γ_{39}	$\eta_b(2S) \omega$	$< 5.6 \times 10^{-3}$	90%	DESIG=43

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{40}	ϕ anything	$(13.8 \begin{smallmatrix} +2.4 \\ -1.7 \end{smallmatrix}) \%$		DESIG=12
Γ_{41}	D^0 anything + c.c.	$(112 \pm 6) \%$		DESIG=13
Γ_{42}	D_s anything + c.c.	$(44.7 \pm 2.6) \%$		DESIG=6
Γ_{43}	J/ψ anything	$(2.06 \pm 0.21) \%$		DESIG=14
Γ_{44}	B^0 anything + c.c.	$(77 \pm 8) \%$		DESIG=21
Γ_{45}	B^+ anything + c.c.	$(72 \pm 6) \%$		DESIG=22

 $\Upsilon(10860)$ PARTIAL WIDTHS

NODE=M092220

 $\Gamma(e^+ e^-)$ **Γ_{15}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.31 \pm 0.07 OUR AVERAGE	Error includes scale factor of 1.3.		
0.22 \pm 0.05 \pm 0.07	BESSION	85	CLEO $e^+ e^- \rightarrow$ hadrons
0.365 \pm 0.070	LOVELOCK	85	CUSB $e^+ e^- \rightarrow$ hadrons

NODE=M092W1
NODE=M092W1 **$\Gamma(e^+ e^-) \times \Gamma(\Upsilon(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$** **$\Gamma_{15} \Gamma_{17} / \Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.09 \pm 0.34	^{1,2} MIZUK	19	BELL $e^+ e^- \rightarrow \Upsilon(nS) \pi^+ \pi^-$

NODE=M092R50
NODE=M092R50

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a simultaneous fit to the $\Upsilon(nS) \pi^+ \pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6$ –11.05 GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092R50;LINKAGE=A

² Reported as the range 0.75–1.43 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R50;LINKAGE=B

 $\Gamma(e^+ e^-) \times \Gamma(\Upsilon(2S) \pi^+ \pi^-) / \Gamma_{\text{total}}$ **$\Gamma_{15} \Gamma_{20} / \Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
2.58 \pm 1.22	^{1,2} MIZUK	19	BELL $e^+ e^- \rightarrow \Upsilon(nS) \pi^+ \pi^-$

NODE=M092R51
NODE=M092R51

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a simultaneous fit to the $\Upsilon(nS) \pi^+ \pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6$ –11.05 GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092R51;LINKAGE=A

² Reported as the range 1.35–3.80 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R51;LINKAGE=B

$$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{22}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
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NODE=M092R52
NODE=M092R52

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.73±0.30	1,2 MIZUK	19	BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092R52;LINKAGE=A

² Reported as the range 0.43–1.03 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R52;LINKAGE=B

$\Upsilon(10860)$ BRANCHING RATIOS

NODE=M092230

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>.

NODE=M092230

$$\Gamma(B\bar{B}X)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M092R13
NODE=M092R13

0.762^{+0.027}_{-0.043} OUR EVALUATION (Produced by HFLAV)

→ UNCHECKED ←

0.71 ± 0.06 OUR AVERAGE

0.737±0.032±0.051	1063	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
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NODE=M092R13;LINKAGE=DR

0.589±0.100±0.092		² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$
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NODE=M092R13;LINKAGE=HU

¹ Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \rightarrow B^{\pm,0}$ anything.

² Using measurements or limits from AQUINES 06.

$$\Gamma(B\bar{B})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE (units 10 ⁻²)	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M092R16
NODE=M092R16

5.5^{+1.0}_{-0.9} ± 0.4		¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.8	90	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$
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NODE=M092R16;LINKAGE=DR

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

NODE=M092R16;LINKAGE=HU

$$\Gamma(B\bar{B})/\Gamma(B\bar{B}X) \quad \Gamma_2/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M092R05
NODE=M092R05

<0.22	90	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$
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$$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M092R15
NODE=M092R15

0.137±0.016 OUR AVERAGE

0.137±0.013±0.011		¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
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NODE=M092R15;LINKAGE=DR

0.143±0.053±0.027		² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$
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NODE=M092R15;LINKAGE=HU

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

$$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X) \quad \Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M092R06
NODE=M092R06

0.24±0.09±0.03	10	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$
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$$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M092R14
NODE=M092R14

0.381±0.034 OUR AVERAGE

0.375 ^{+0.021} _{-0.019} ± 0.030		¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
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NODE=M092R14;LINKAGE=DR

0.436±0.083±0.072		² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$
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NODE=M092R14;LINKAGE=HU

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

$$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X) \quad \Gamma_4/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M092R07
NODE=M092R07

0.74±0.15±0.08	31	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow \text{hadrons}$
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$$\Gamma(B\bar{B}^*(*)\pi)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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NODE=M092R17
NODE=M092R17

<0.197	90	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$
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¹ Using measurements or limits from AQUINES 06.

NODE=M092R17;LINKAGE=HU

$$\Gamma(B\bar{B}^*\pi)/\Gamma(B\bar{B}X)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_1
<0.32	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons	

NODE=M092R08
NODE=M092R08

$$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
$0.0 \pm 1.2 \pm 0.3$	0	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$	

NODE=M092R28
NODE=M092R28

¹ Assuming isospin conservation.

NODE=M092R28;LINKAGE=DR

$$[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ
$7.3^{+2.3}_{-2.1} \pm 0.8$	38	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$	

NODE=M092R29
NODE=M092R29

¹ Assuming isospin conservation.

NODE=M092R29;LINKAGE=DR

$$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_8/Γ
$1.0^{+1.4}_{-1.3} \pm 0.4$	5	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+,0}\pi^- X$	

NODE=M092R30
NODE=M092R30

¹ Assuming isospin conservation.

NODE=M092R30;LINKAGE=DR

$$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ
<0.089	90	¹ HUANG	07	CLEO $\Upsilon(5S) \rightarrow$ hadrons	

NODE=M092R18
NODE=M092R18

¹ Using measurements or limits from AQUINES 06.

NODE=M092R18;LINKAGE=HU

$$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_9/Γ_1
<0.14	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons	

NODE=M092R09
NODE=M092R09

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	$\Gamma_{10}/\Gamma = (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})/\Gamma$
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NODE=M092R01
NODE=M092R01

$$0.201^{+0.030}_{-0.031} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$0.189^{+0.027}_{-0.021} \text{ OUR AVERAGE}$$

0.172 ± 0.030	¹ ESEN	13	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
$0.21^{+0.06}_{-0.03}$	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow D_s X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.180 \pm 0.013 \pm 0.032$	³ DRUTSKOY	07	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
$0.160 \pm 0.026 \pm 0.058$	⁴ ARTUSO	05B	CLEO	$e^+ e^- \rightarrow D_s X$

¹ Supersedes DRUTSKOY 07.

² Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using $B(D_s^+ \rightarrow \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.

³ Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

⁴ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

NODE=M092R01;LINKAGE=ES
NODE=M092R01;LINKAGE=HU

NODE=M092R01;LINKAGE=DR
NODE=M092R01;LINKAGE=AR

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X)$$

VALUE	DOCUMENT ID	Γ_{10}/Γ_1
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NODE=M092R34
NODE=M092R34

$$0.264^{+0.052}_{-0.045} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$\Gamma(B_s^*\bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	$\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$
87.8 ± 1.5		^{1,2} ESEN	13	BELL $B_s^0 \rightarrow D_s^- \pi^+$	
$90.5 \pm 3.2 \pm 0.1$	227	^{2,3} LI	12	BELL $B_s^0 \rightarrow J/\psi\eta^{(\prime)}$	

NODE=M092R19
NODE=M092R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

$90.1^{+3.8}_{-4.0} \pm 0.2$	⁴ LOUVOT	09	BELL	$10.86 e^+ e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
$93^{+7}_{-9} \pm 1$	⁴ DRUTSKOY	07A	BELL	Superseded by LOUVOT 09

¹Supersedes LOUVOT 09.

²With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³The ratios $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ and $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

⁴From a measurement of $\sigma(e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}) / \sigma(e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.

NODE=M092R19;LINKAGE=ES

NODE=M092R19;LINKAGE=IL

NODE=M092R19;LINKAGE=LI

NODE=M092R19;LINKAGE=DR

$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$		$\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$		
VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	
$2.6^{+2.6}_{-2.5}$	LOUVOT	09	BELL	$10.86 e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

NODE=M092R24
NODE=M092R24

$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$		Γ_{11}/Γ_{13}		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3 e^+e^-

NODE=M092R03
NODE=M092R03

$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$		$\Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$		
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7 ± 1.2 OUR AVERAGE				

NODE=M092R25
NODE=M092R25

7.3 ± 1.4		^{1,2} ESEN	13	BELL	$B_s^0 \rightarrow D_s^- \pi^+$
$4.9 \pm 2.5 \pm 0.0$	227	^{2,3} LI	12	BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.3^{+3.3}_{-3.0} \pm 0.1$		LOUVOT	09	BELL	$10.86 e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
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¹Supersedes LOUVOT 09.

²With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³The ratios $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ and $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

NODE=M092R25;LINKAGE=ES

NODE=M092R25;LINKAGE=IL

NODE=M092R25;LINKAGE=LI

$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$		Γ_{12}/Γ_{13}		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3 e^+e^-

NODE=M092R04
NODE=M092R04

$\Gamma(\text{no open-bottom})/\Gamma_{\text{total}}$		Γ_{14}/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.038^{+0.051}_{-0.005}$ OUR EVALUATION				

NODE=M092R33
NODE=M092R33

→ UNCHECKED ←

$\Gamma(K^*(892)^0 \bar{K}^0)/\Gamma_{\text{total}}$		Γ_{16}/Γ		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-5}$	90	SHEN	13A	BELL $e^+e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M092R35
NODE=M092R35

$\Gamma(\eta \Upsilon_J(1D))/\Gamma_{\text{total}}$		Γ_{24}/Γ		
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT	
$4.82 \pm 0.92 \pm 0.67$	¹ TAMPONI	18	BELL	$e^+e^- \rightarrow \Upsilon(5S) \rightarrow \eta X$

NODE=M092R48
NODE=M092R48

¹Mainly $J = 2$, assumes no continuum contribution under $\Upsilon(5S)$.

NODE=M092R48;LINKAGE=A

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$		Γ_{17}/Γ		
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	¹ CHEN	08	BELL $10.87 e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

¹Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R20;LINKAGE=CH

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$		Γ_{18}/Γ		
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT	
$0.85 \pm 0.15 \pm 0.08$	^{1,2} KOVALENKO	21	BELL	$e^+e^- \rightarrow \Upsilon(5S)$

NODE=M092R55
NODE=M092R55

¹Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R55;LINKAGE=A

²Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

NODE=M092R55;LINKAGE=B

$\Gamma(\Upsilon(1S)\eta')/\Gamma_{\text{total}}$		Γ_{19}/Γ		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.9 \times 10^{-5}$	90	^{1,2} KOVALENKO	21	BELL $e^+e^- \rightarrow \Upsilon(5S)$

NODE=M092R56
NODE=M092R56

¹Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R56;LINKAGE=A

²Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

NODE=M092R56;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	¹ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R21
NODE=M092R21

NODE=M092R21;LINKAGE=CH

 $\Gamma(\Upsilon(2S)\eta)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$4.13 \pm 0.41 \pm 0.37$	^{1,2} KOVALENKO	21	BELL $e^+ e^- \rightarrow \Upsilon(5S)$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

² Using a data sample of 118.3 fb^{-1} of $e^+ e^-$ collisions at $\sqrt{s} = 10.866 \text{ GeV}$.

NODE=M092R57
NODE=M092R57

NODE=M092R57;LINKAGE=A
NODE=M092R57;LINKAGE=B

 $\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8 \pm 1.8 \pm 0.7$	10	¹ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R22
NODE=M092R22

NODE=M092R22;LINKAGE=CH

 $\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1 \pm 1.6 \pm 1.0$	20	¹ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R23
NODE=M092R23

NODE=M092R23;LINKAGE=CH

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ Γ_{25}/Γ_{20}

VALUE	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.08 \pm 0.07$ -0.12	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R31
NODE=M092R31

 $\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ Γ_{26}/Γ_{20}

VALUE	DOCUMENT ID	TECN	COMMENT
$0.77 \pm 0.08 \pm 0.22$ -0.17	ADACHI	12	BELL $10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R32
NODE=M092R32

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-)$ Γ_{25}/Γ_{26}

VALUE	DOCUMENT ID	TECN	COMMENT
$0.616 \pm 0.052 \pm 0.017$	MIZUK	16	BELL $e^+ e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$

NODE=M092R00
NODE=M092R00

 $\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.6 \pm 2.2$	YIN	18	BELL $e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R49
NODE=M092R49

 $\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.3 \times 10^{-3}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R36
NODE=M092R36

NODE=M092R36;LINKAGE=A

 $\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.9 \times 10^{-3}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R37
NODE=M092R37

NODE=M092R37;LINKAGE=A

 $\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.8 \times 10^{-3}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R38
NODE=M092R38

NODE=M092R38;LINKAGE=A

 $\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.85 \pm 0.23 \pm 0.23$	80	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R39
NODE=M092R39

NODE=M092R39;LINKAGE=A

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.57 \pm 0.22 \pm 0.21$	60	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R40
NODE=M092R40

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R40;LINKAGE=A

 $\Gamma(\chi_{b1}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.15 \pm 0.11$	24	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R41
NODE=M092R41

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R41;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.17 \pm 0.27 \pm 0.14$	29	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R42
NODE=M092R42

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R42;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.60 \pm 0.23 \pm 0.15$	13	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R43
NODE=M092R43

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R43;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ Γ_{35}/Γ_{32}

VALUE	DOCUMENT ID	TECN	COMMENT
$0.38 \pm 0.16 \pm 0.09$	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R44
NODE=M092R44

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Accounting for correlated systematics.

NODE=M092R44;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.61 \pm 0.22 \pm 0.28$	16	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R45
NODE=M092R45

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R45;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma(\chi_{b1}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})$ Γ_{36}/Γ_{33}

VALUE	DOCUMENT ID	TECN	COMMENT
$1.20 \pm 0.55 \pm 0.65$	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R46
NODE=M092R46

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Accounting for correlated systematics.

NODE=M092R46;LINKAGE=A

 $\Gamma(\eta_b(1S)\omega)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.3 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$

NODE=M092R53
NODE=M092R53

¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

NODE=M092R53;LINKAGE=A

 $\Gamma(\eta_b(2S)\omega)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.6 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$

NODE=M092R54
NODE=M092R54

¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

NODE=M092R54;LINKAGE=A

 $\Gamma(\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.8 \times 10^{-5}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

NODE=M092R47
NODE=M092R47

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between $10.55 \text{ GeV}/c^2$ and $10.65 \text{ GeV}/c^2$, the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5} .

NODE=M092R47;LINKAGE=A

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{40}/Γ
$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$	NODE=M092R12 NODE=M092R12

 $\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{41}/Γ
$1.117 \pm 0.005 \pm 0.060$	¹ ZHUKOVA	23	BELL $\Upsilon(5S) \rightarrow D^0 X, \bar{D}^0 X$	NODE=M092R10 NODE=M092R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.076 \pm 0.040 \pm 0.068$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D^0 X, \bar{D}^0 X$	
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¹Supersedes DRUTSKOY 07.

NODE=M092R10;LINKAGE=A

 $\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{42}/Γ
0.447 ± 0.026 OUR AVERAGE				NODE=M092R02 NODE=M092R02

$0.447 \pm 0.003 \pm 0.027$	¹ ZHUKOVA	23	BELL $\Upsilon(5S) \rightarrow D_s^\pm X$	
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$0.44 \pm 0.09 \pm 0.04$	² ARTUSO	05B	CLE3 $\Upsilon(5S) \rightarrow D_s^\pm X$	
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.472 \pm 0.024 \pm 0.072$	³ DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s^\pm X$	
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¹Supersedes DRUTSKOY 07.

NODE=M092R02;LINKAGE=A

²ARTUSO 05B reports $[\Upsilon(10860) \rightarrow D_s \text{ anything} + \text{c.c.}]/\Gamma_{\text{total}} \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$ which we divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M092R02;LINKAGE=AR

³Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

NODE=M092R02;LINKAGE=DR

 $\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	Γ_{43}/Γ
2.060 ± 0.160 ± 0.134	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$	NODE=M092R11 NODE=M092R11

 $\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{44}/Γ
$0.770^{+0.058}_{-0.056} \pm 0.061$	352	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^0 X$	NODE=M092R26 NODE=M092R26

 $\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_{45}/Γ
$0.721^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+ X$	NODE=M092R27 NODE=M092R27

 $\Upsilon(10860)$ REFERENCES

Author	Year	Journal	Volume	Page	Collaboration	REFID	
ZHUKOVA	23	JHEP	2308	131	V. Zhukova <i>et al.</i>	(BELLE Collab.)	REFID=62312
KOVALENKO	21	PR	D104	112006	E. Kovalenko <i>et al.</i>	(BELLE Collab.)	REFID=61452
DONG	20A	CP	C44	083001	X.-K. Dong <i>et al.</i>		REFID=60595
OSKIN	20	PR	D102	092011	P. Oskin <i>et al.</i>	(BELLE Collab.)	REFID=60735
MIZUK	19	JHEP	1910	220	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=60090
TAMPONI	18	EPJ	C78	633	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=59195
YIN	18	PR	D98	091102	J.H. Yin <i>et al.</i>	(BELLE Collab.)	REFID=59468
MIZUK	16	PRL	117	142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=57465
SANTEL	16	PR	D93	011101	D. Santel <i>et al.</i>	(BELLE Collab.)	REFID=57121
TAMPONI	15	PRL	115	142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=56996
HE	14	PRL	113	142001	X.H. He <i>et al.</i>	(BELLE Collab.)	REFID=55927
ESEN	13	PR	D87	031101	S. Esen <i>et al.</i>	(BELLE Collab.)	REFID=54894
SHEN	13A	PR	D88	052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55591
ADACHI	12	PRL	108	032001	I. Adachi <i>et al.</i>	(BELLE Collab.)	REFID=53962
LI	12	PRL	108	181808	J. Li <i>et al.</i>	(BELLE Collab.)	REFID=54116
CHEN	10	PR	D82	091106	K.-F. Chen <i>et al.</i>	(BELLE Collab.)	REFID=53531
DRUTSKOY	10	PR	D81	112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=53358
AUBERT	09E	PRL	102	012001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52661
LOUVOT	09	PRL	102	021801	R. Louvot <i>et al.</i>	(BELLE Collab.)	REFID=52646
CHEN	08	PRL	100	112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)	REFID=52153
DRUTSKOY	07	PRL	98	052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=51621
DRUTSKOY	07A	PR	D76	012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=51852
HUANG	07	PR	D75	012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=51624
AQUINES	06	PRL	96	152001	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51106
BONVICINI	06	PRL	96	022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=50995
PDG	06	JP	G33	1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
ARTUSO	05B	PRL	95	261801	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50992
BESSION	85	PRL	54	381	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22368
LOVELOCK	85	PRL	54	377	D.M.J. Lovelock <i>et al.</i>	(CUSP Collab.)	REFID=22369

NODE=M092

$\Upsilon(11020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M093

 $\Upsilon(11020)$ MASS

NODE=M093M

NODE=M093M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11000 ± 4 OUR AVERAGE			
11000.0 ^{+4.0+1.0} _{-4.5-1.3}	1 MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10999.0 ^{+7.3+16.9} _{-7.8-1.0}	2 MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
11001 ± 1	3 DONG	20A	$e^+e^- \rightarrow b\bar{b}$
11003.0 ± 1.1 ^{+0.9} _{-1.0}	4,5 SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
10987.5 ^{+6.4+9.1} _{-2.5-2.3}	6,7 SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10996 ± 2	8 AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
11019 ± 5 ± 7	BESSION	85 CLEO	$e^+e^- \rightarrow$ hadrons
11020 ± 30	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M093M;LINKAGE=E

² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M093M;LINKAGE=D

³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M093M;LINKAGE=G

⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M093M;LINKAGE=A

⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

NODE=M093M;LINKAGE=B

⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M093M;LINKAGE=C

⁷ Superseded by MIZUK 19.

NODE=M093M;LINKAGE=F

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093M;LINKAGE=AU

 $\Upsilon(11020)$ WIDTH

NODE=M093W

NODE=M093W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
24⁺⁸₋₆ OUR AVERAGE			
23.8 ^{+8.0+0.7} _{-6.8-1.8}	1 MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
27 ⁺²⁷⁺⁵ ₋₁₁₋₁₂	2 MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
35.1 ± 1.2	3 DONG	20A	$e^+e^- \rightarrow b\bar{b}$
39.3 ^{+1.7+1.3} _{-1.6-2.4}	4,5 SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
61 ⁺⁹⁺² ₋₁₉₋₂₀	6,7 SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
37 ± 3	8 AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
61 ± 13 ± 22	BESSION	85 CLEO	$e^+e^- \rightarrow$ hadrons
90 ± 20	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

- ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$. NODE=M093W;LINKAGE=E
- ² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude. NODE=M093W;LINKAGE=D
- ³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths. NODE=M093W;LINKAGE=G
- ⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient). NODE=M093W;LINKAGE=A
- ⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions. NODE=M093W;LINKAGE=B
- ⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n=1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero. NODE=M093W;LINKAGE=C
- ⁷ Superseded by MIZUK 19. NODE=M093W;LINKAGE=F
- ⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated. NODE=M093W;LINKAGE=AU

$\Upsilon(11020)$ DECAY MODES

NODE=M093215;NODE=M093

Mode	Fraction (Γ_i/Γ)	
Γ_1 e^+e^-	$(5.4^{+1.9}_{-2.1}) \times 10^{-6}$	DESIG=1
Γ_2 $\Upsilon(1S)\pi^+\pi^-$		DESIG=5
Γ_3 $\Upsilon(2S)\pi^+\pi^-$		DESIG=6
Γ_4 $\Upsilon(3S)\pi^+\pi^-$		DESIG=7
Γ_5 $\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(9^{+9}_{-8}) \times 10^{-3}$	DESIG=2
Γ_6 $\chi_{b1}(1P)\pi^+\pi^-\pi^0$	seen	DESIG=3
Γ_7 $\chi_{b2}(1P)\pi^+\pi^-\pi^0$	seen	DESIG=4

$\Upsilon(11020)$ PARTIAL WIDTHS

NODE=M093220

$\Gamma(e^+e^-)$				Γ_1	
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
0.130 ± 0.030 OUR AVERAGE					NODE=M093W1 NODE=M093W1
0.095 ± 0.03 ± 0.035	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons		
0.156 ± 0.040	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons		

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_2/\Gamma$	
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.46 ± 0.08 ^{1,2} MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$. NODE=M093R04;LINKAGE=A

² Reported as the range 0.38–0.54 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions. NODE=M093R04;LINKAGE=B

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_3/\Gamma$	
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.65 ± 0.52 ^{1,2} MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$. NODE=M093R05;LINKAGE=A

² Reported as the range 0.13–1.16 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions. NODE=M093R05;LINKAGE=B

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_4/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
------------	-------------	------	---------

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.33±0.16	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
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¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.17–0.49 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M093R06
NODE=M093R06

NODE=M093R06;LINKAGE=A

NODE=M093R06;LINKAGE=B

 $\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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$8.7 \pm 4.3^{+7.6}_{-6.6}$	YIN	18	BELL $e^+e^- \rightarrow$ hadrons
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NODE=M093R00
NODE=M093R00

 $\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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seen	YIN	18	BELL $e^+e^- \rightarrow$ hadrons
------	-----	----	-----------------------------------

NODE=M093R01
NODE=M093R01

 $\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

seen	YIN	18	BELL $e^+e^- \rightarrow$ hadrons
------	-----	----	-----------------------------------

NODE=M093R02
NODE=M093R02

 $\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
-------	-------------	------	---------

0.4 ± 0.2	YIN	18	BELL $e^+e^- \rightarrow$ hadrons
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NODE=M093R03
NODE=M093R03

 $\Upsilon(11020)$ REFERENCES

DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>	
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)
YIN	18	PR D98 091102	J.H. Yin <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSP Collab.)

NODE=M093

REFID=60595
REFID=60090
REFID=59468
REFID=57465
REFID=57121
REFID=52661
REFID=22368
REFID=22369

OTHER MESONS

NODE=MXXX050

NODE=M250

$T_{cs0}^*(2870)^0$

$I(J^P) = ?(0^+)$

OMITTED FROM SUMMARY TABLE
was $X_0(2900)$

An exotic state with minimal quark content $\bar{c}d\bar{s}u$. Observed by AAIJ 20AI using full amplitude analysis of $B^+ \rightarrow D^+ D^- K^+$ decays.

NODE=M250

 $T_{cs0}^*(2870)^0$ MASS

NODE=M250M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

2872 ± 16 OUR AVERAGE Error includes scale factor of 2.4. [2866 ± 7 MeV OUR 2024 AVERAGE]

NODE=M250M
NEW

2914 ± 11 ± 15	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*+} D^- K^+$
2866 ± 7 ± 2	1.2k	² AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M250M;LINKAGE=B

NODE=M250M;LINKAGE=A

 $T_{cs0}^*(2870)^0$ WIDTH

NODE=M250W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
-------------	------	-------------	------	---------

67 ± 24 OUR AVERAGE Error includes scale factor of 2.1. [57 ± 13 MeV OUR 2024 AVERAGE]

NODE=M250W
NEW

128 ± 22 ± 23	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*+} D^- K^+$
57 ± 12 ± 4	1.2k	² AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*-} K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M250W;LINKAGE=B

NODE=M250W;LINKAGE=A

$T_{cs0}^*(2870)^0$ DECAY MODES

NODE=M250215;NODE=M250

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^- K^+$	seen

DESIG=1

$T_{cs0}^*(2870)^0$ BRANCHING RATIOS

NODE=M250225

$\Gamma(D^- K^+)/\Gamma_{total}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M250R01
NODE=M250R01

$T_{cs0}^*(2870)^0$ REFERENCES

NODE=M250

AAIJ	24AB PRL 133 131902	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AF PRL 125 242001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AI PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=63014
REFID=60702
REFID=60739

NODE=M251

$T_{cs1}^*(2900)^0$

 $I(J^P) = ?(1^-)$

OMITTED FROM SUMMARY TABLE

was $X_1(2900)$

An exotic state with minimal quark content $\bar{c}d\bar{s}u$. Observed by AAIJ 20AI using full amplitude analysis of $B^+ \rightarrow D^+ D^- K^+$ decays.

NODE=M251

$T_{cs1}^*(2900)^0$ MASS

NODE=M251M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2887 \pm 8 \pm 7	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*+} D^- K^+$
2904 \pm 5 \pm 1	1.2k	² AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M251M

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M251M;LINKAGE=C

² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M251M;LINKAGE=B

$T_{cs1}^*(2900)^0$ WIDTH

NODE=M251W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
106 \pm 10 OUR AVERAGE [110 \pm 12 MeV OUR 2024 AVERAGE]				
92 \pm 16 \pm 16	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*+} D^- K^+$
110 \pm 11 \pm 4	1.2k	² AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M251W

NEW

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M251W;LINKAGE=B

² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M251W;LINKAGE=A

$T_{cs1}^*(2900)^0$ DECAY MODES

NODE=M251215;NODE=M251

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^- K^+$	seen

DESIG=1

$T_{cs1}^*(2900)^0$ BRANCHING RATIOS

NODE=M251225

$\Gamma(D^- K^+)/\Gamma_{total}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	20AI LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M251R01
NODE=M251R01

$T_{c\bar{s}0}^*(2900)^0$ REFERENCES

AAIJ	24AB PRL 133 131902	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AF PRL 125 242001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AI PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M251

REFID=63014
REFID=60702
REFID=60739 **$T_{c\bar{s}0}^*(2900)$**

$$I(J^P) = 1(0^+)$$

OMITTED FROM SUMMARY TABLE

Observed by LHCb in AAIJ 23B using a simultaneous amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^+ \rightarrow D^- D_s^+ \pi^+$. The $T_{c\bar{s}0}^*(2900)^0 \rightarrow D_s^+ \pi^-$ and $T_{c\bar{s}0}^*(2900)^{++} \rightarrow D_s^+ \pi^+$ decays are observed with 8.0 and 6.5 σ significance, respectively.

NODE=M269

NODE=M269

 $T_{c\bar{s}0}^*(2900)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2892 \pm 14 \pm 15$	¹ AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$

NODE=M269M

NODE=M269M

¹From an amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a mass of $2908 \pm 11 \pm 20$ MeV.

NODE=M269M;LINKAGE=A

 $T_{c\bar{s}0}^*(2900)^{++}$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2921 \pm 17 \pm 20$	² AAIJ	23C	LHCB $B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269M++

NODE=M269M++

²From an amplitude analysis of $B^- \rightarrow D^- D_s^+ \pi^+$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a mass of $2908 \pm 11 \pm 20$ MeV.

NODE=M269M++;LINKAGE=A

 $T_{c\bar{s}0}^*(2900)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$119 \pm 26 \pm 13$	³ AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$

NODE=M269W

NODE=M269W

³From an amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a width of $136 \pm 23 \pm 13$ MeV.

NODE=M269W;LINKAGE=A

 $T_{c\bar{s}0}^*(2900)^{++}$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$137 \pm 32 \pm 17$	⁴ AAIJ	23C	LHCB $B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269W++

NODE=M269W++

⁴From an amplitude analysis of $B^- \rightarrow D^- D_s^+ \pi^+$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a width of $136 \pm 23 \pm 13$ MeV.

NODE=M269W++;LINKAGE=A

 $T_{c\bar{s}0}^*(2900)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \pi^-$	seen
Γ_2 $D_s^+ \pi^+$	seen

NODE=M269215;NODE=M269

DESIG=1

DESIG=2

 $T_{c\bar{s}0}^*(2900)$ BRANCHING RATIOS

$\Gamma(D_s^+ \pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$	

NODE=M269225

NODE=M269R01
NODE=M269R01

$\Gamma(D_s^+ \pi^+)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23C LHCb	$B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269R02
 NODE=M269R02

 $T_{c\bar{s}0}^*(2900)$ REFERENCES

AAIJ	23B PR D108 012017	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	23C PRL 131 041902	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M269

REFID=62091
 REFID=62094

NODE=M265

 $T_{cc}(3875)^+$

$$I(J^P) = ?(??)$$

OMITTED FROM SUMMARY TABLE

Observed with large significance by AAIJ 22E in the doubly-charmed
 (C = 2) decay mode $D^0 D^0 \pi^+$ using inclusive pp collisions at 7, 8,
 and 13 TeV.

NODE=M265

 $T_{cc}(3875)^+$ T-Matrix Pole \sqrt{s}

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$(-0.360 \pm 0.040_{-0.000}^{+0.004})$ $- i(0.024 \pm 0.001_{-0.007}^{+0.000})$	117	¹ AAIJ	22Z LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$

NODE=M265TMP

NODE=M265TMP

¹ Fit uses coupled channel model accounting for $D^0 D^{*+}$ threshold.

NODE=M265TMP;LINKAGE=A

 $T_{cc}(3875)^+$ MASS

OUR FIT value comes from the measurement of $m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0})$
 below and $m_{D^{*+}} + m_{D^0}$ values.

NODE=M265M

NODE=M265M

VALUE (MeV)	DOCUMENT ID
3874.74 ± 0.10 OUR FIT [3874.83 \pm 0.11 MeV OUR 2024 FIT]	

NODE=M265M
 NEW

 $m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0})$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
-0.36 ± 0.04 OUR FIT [-0.27 ± 0.06 MeV OUR 2024 FIT]				
-0.36 ± 0.04 OUR AVERAGE [-0.27 ± 0.06 MeV OUR 2024 AVERAGE]				
$-0.360 \pm 0.040_{-0.000}^{+0.004}$	117	¹ AAIJ	22Z LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$

NODE=M265DM
 NODE=M265DM
 NEW

NEW

$-0.273 \pm 0.061_{-0.015}^{+0.012}$	117	² AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$
--------------------------------------	-----	-------------------	----------	----------------------------------

¹ Fit uses coupled channel model accounting for $D^0 D^{*+}$ threshold.

² The fit uses a relativistic P -wave Breit-Wigner function without taking into account the
 $D^0 D^{*+}$ threshold. Parameters are shown to be biased in AAIJ 22Z. The significance for
 $m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0}) < 0$ is 4.3 σ .

NODE=M265DM;LINKAGE=B
 NODE=M265DM;LINKAGE=A

 $T_{cc}(3875)^+$ WIDTH

NODE=M265W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.048_{-0.0141}^{+0.0020}$ OUR AVERAGE [0.41 \pm 0.17 MeV OUR 2024 AVERAGE]				

NODE=M265W

NEW

$0.048 \pm 0.002_{-0.014}^{+0.000}$	117	¹ AAIJ	22Z LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.410 \pm 0.165_{-0.057}^{+0.047}$	117	² AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$
-------------------------------------	-----	-------------------	----------	----------------------------------

¹ Fit uses coupled channel model accounting for $D^0 D^{*+}$ threshold.

² The fit uses a relativistic P -wave Breit-Wigner function without taking into account the
 $D^0 D^{*+}$ threshold. The fit uses a relativistic P -wave Breit-Wigner function. Parameters
 are shown to be biased in AAIJ 22Z.

NODE=M265W;LINKAGE=B
 NODE=M265W;LINKAGE=A

$T_{cc}(3875)^+$ DECAY MODES

NODE=M265215;NODE=M265

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 D^0 \pi^+$	seen

DESIG=1

 $T_{cc}(3875)^+$ BRANCHING RATIOS

NODE=M265225

$\Gamma(D^0 D^0 \pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	117	AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$	

NODE=M265R01
NODE=M265R01 **$T_{cc}(3875)^+$ REFERENCES**

NODE=M265

AAIJ	22E NATP 18 751	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61658
AAIJ	22Z NATC 13 3351	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=63218

NODE=M210

 $T_{c\bar{c}1}(3900)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

was $Z_c(3900)$, $X(3900)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M210

Charged $T_{c\bar{c}1}(3900)^\pm$ seen as a peak in the invariant mass distribution of the $J/\psi \pi^\pm$ system by BES III (ABLIKIM 13T) in $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ at c.m. energy of 4.26 GeV and by radiative return from $e^+ e^-$ collisions at \sqrt{s} from 9.46 to 10.86 GeV at Belle (LIU 13B). Partial wave analysis of ABLIKIM 17J determines $J^P = 1^+$ with more than 7σ significance. Neutral $T_{c\bar{c}1}(3900)^0$ seen in the $J/\psi \pi^0$ invariant mass distribution in $e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$ at c.m. energies of 4.23, 4.26, and 4.36 GeV by BES III (ABLIKIM 15U) and at 4.17 GeV by XIAO 13A. Peaks in $(D\bar{D}^*)^{0,\pm}$ reported by BES III (ABLIKIM 14A, ABLIKIM 15AB) are assumed to be related.

 $T_{c\bar{c}1}(3900)$ MASS

NODE=M210M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3887.1 ± 2.6 OUR AVERAGE		Error includes scale factor of 1.7.			See the ideogram below.
$3893.1 \pm 2.2 \pm 3.0$		¹ ABLIKIM	20N BES3	0	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
$3902.6^{+5.2+3.3}_{-5.0-1.4}$		^{2,3} ABAZOV	19 D0	\pm	1.96 TeV $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
$3881.2 \pm 4.2 \pm 52.7$	6k	⁴ ABLIKIM	17J BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
$3885.7^{+4.3}_{-5.7} \pm 8.4$		^{2,4} ABLIKIM	15AB BES3	0	$e^+ e^- \rightarrow \pi^0 (D\bar{D}^*)^0$
$3881.7 \pm 1.6 \pm 1.6$	1.2k	^{2,4} ABLIKIM	15AC BES3	\pm	$e^+ e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$
$3883.9 \pm 1.5 \pm 4.2$	1.2k	^{2,4} ABLIKIM	14A BES3	\pm	$e^+ e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$
$3894.5 \pm 6.6 \pm 4.5$	159	² LIU	13B BELL	\pm	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
$3886 \pm 4 \pm 2$	81	^{2,5} XIAO	13A	\pm	$4.17 e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
$3904 \pm 9 \pm 5$	25	^{2,5} XIAO	13A	0	$4.17 e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$

NODE=M210M

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3895.0 \pm 5.2^{+4.0}_{-2.7}$	502	^{2,6} ABAZOV	18B D0	\pm	1.96 TeV $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
$3894.8 \pm 2.3 \pm 3.2$	356	^{2,7} ABLIKIM	15U BES3	0	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
$3899.0 \pm 3.6 \pm 4.9$	307	^{2,8} ABLIKIM	13T BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

OCCUR=2

¹ Pole mass obtained from a fit to a relativistic Breit-Wigner.

² Neglecting interference between the $T_{c\bar{c}1}(3900)$ and other processes.

³ Measured in weak decays of b -flavored hadrons (nonprompt).

⁴ Pole mass obtained from a fit to a Flatte-like formula.

⁵ For $M^2(\pi^+ \pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

⁶ The signal of the $T_{c\bar{c}1}(3900)$ is correlated with a parent $J/\psi \pi^+ \pi^-$ system in the invariant mass range 4.2–4.7 GeV. Superseded by ABAZOV 19.

NODE=M210M;LINKAGE=L

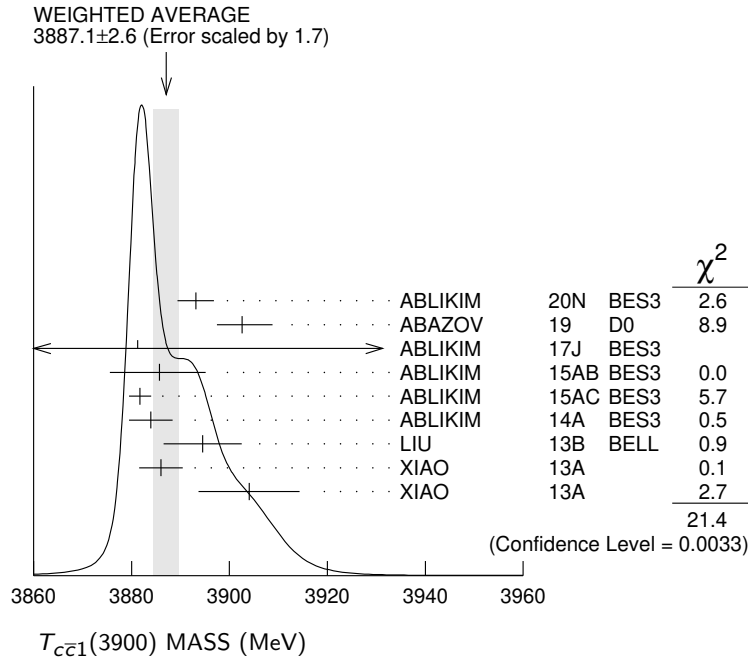
NODE=M210M;LINKAGE=A

NODE=M210M;LINKAGE=G

NODE=M210M;LINKAGE=E

NODE=M210M;LINKAGE=B

NODE=M210M;LINKAGE=F

⁷ Superseded by ABLIKIM 20N.⁸ Superseded by ABLIKIM 17J.NODE=M210M;LINKAGE=J
NODE=M210M;LINKAGE=K **$T_{c\bar{c}1}(3900)$ WIDTH**

NODE=M210W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
28.4 ± 2.6 OUR AVERAGE						
44.4 ± 5.2 ± 14.0		¹ ABLIKIM	20N	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
32 ⁺²⁸ ₋₂₁ ⁺²⁶ ₋₇		^{2,3} ABAZOV	19	D0	±	1.96 TeV $p\bar{p} \rightarrow \pi^+\pi^- J/\psi X$ (non-prompt)
51.8 ± 4.6 ± 36.0	6 k	⁴ ABLIKIM	17J	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
35 ⁺¹¹ ₋₁₂ ± 15		^{2,4} ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
26.6 ± 2.0 ± 2.1	1248	^{2,4} ABLIKIM	15AC	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
24.8 ± 3.3 ± 11.0	1212	^{2,4} ABLIKIM	14A	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
63 ± 24 ± 26	159	² LIU	13B	BELL	±	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
37 ± 4 ± 8	81	^{2,5} XIAO	13A		±	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

NODE=M210W

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

29.6 ± 8.2 ± 8.2	356	^{2,6} ABLIKIM	15U	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
46 ± 10 ± 20	307	^{2,7} ABLIKIM	13T	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Pole width obtained from a fit to a relativistic Breit-Wigner.² Neglecting interference between the $T_{c\bar{c}1}(3900)$ and other processes.³ Measured in weak decays of b -flavored hadrons (nonprompt).⁴ Pole width obtained from a fit to a Flatte-like formula.⁵ For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.⁶ Superseded by ABLIKIM 20N.⁷ Superseded by ABLIKIM 17J.

NODE=M210W;LINKAGE=G

NODE=M210W;LINKAGE=A

NODE=M210W;LINKAGE=F

NODE=M210W;LINKAGE=E

NODE=M210W;LINKAGE=B

NODE=M210W;LINKAGE=H

NODE=M210W;LINKAGE=I

 $T_{c\bar{c}1}(3900)$ DECAY MODES

NODE=M210215;NODE=M210

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\pi$	seen
Γ_2 $h_c\pi^\pm$	not seen
Γ_3 $\eta_c\pi^+\pi^-$	not seen
Γ_4 $\eta_c(1S)\rho(770)^\pm$	seen
Γ_5 $(D\bar{D}^*)^\pm$	seen

DESIG=1

DESIG=2

DESIG=10

DESIG=11;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

Γ_6	$D^0 D^{*-} + \text{c.c.}$	seen	DESIG=8
Γ_7	$D^- D^{*0} + \text{c.c.}$	seen	DESIG=9
Γ_8	$\omega \pi^\pm$	not seen	DESIG=4
Γ_9	$J/\psi \eta$	not seen	DESIG=5
Γ_{10}	$D^+ D^{*-} + \text{c.c.}$	seen	DESIG=6
Γ_{11}	$D^0 \bar{D}^{*0} + \text{c.c.}$	seen	DESIG=7

$T_{c\bar{c}1}(3900)$ BRANCHING RATIOS

NODE=M210225

$\Gamma(J/\psi \pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen		ABLIKIM	20N	BES3	0	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
seen		¹ ABAZOV	19	D0	\pm	1.96 TeV $p\bar{p} \rightarrow \pi^+ \pi^- J/\psi X$ (prompt)
seen		ABLIKIM	17J	BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
seen	356	ABLIKIM	15U	BES3	0	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$
not seen		² ADOLPH	15D	COMP	\pm	$\gamma N \rightarrow J/\psi \pi^\pm N$
seen	307	ABLIKIM	13T	BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
seen	25	³ XIAO	13A		0	4.17 $e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$

NODE=M210R01
NODE=M210R01¹ But not seen in the "prompt" sample (no b-hadron enhancement).² ADOLPH 15D measure $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm) \sigma(\gamma N \rightarrow T_{c\bar{c}1}(3900)^\pm N) / \sigma(\gamma N \rightarrow J/\psi N) < 3.7 \times 10^{-3}$ at 90% CL.³ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.NODE=M210R01;LINKAGE=C
NODE=M210R01;LINKAGE=A

NODE=M210R01;LINKAGE=XI

$\Gamma(h_c \pi^\pm)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
not seen		ABLIKIM	13X	BES3	\pm	$e^+ e^- \rightarrow h_c \pi^+ \pi^-$

NODE=M210R02
NODE=M210R02

$\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
not seen		¹ VINOKUROVA	15	BELL	0	$B^+ \rightarrow K^+ \eta_c \pi^+ \pi^-$

NODE=M210R11
NODE=M210R11¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ Z_c(3900)^0) \times B(X \rightarrow \eta_c \pi^+ \pi^-) < 4.7 \times 10^{-5}$ at 90% CL.

NODE=M210R11;LINKAGE=VI

$\Gamma(\eta_c(1S) \rho(770)^\pm)/\Gamma(J/\psi \pi)$						Γ_4/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
2.3 ± 0.8	332	¹ ABLIKIM	19BC	BES3		$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \eta_c(1S)$

NODE=M210R12
NODE=M210R12¹ Using $e^+ e^- \rightarrow \pi^\mp (T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm)$ cross section at 4.23 and 4.26 GeV from ABLIKIM 17J.

NODE=M210R12;LINKAGE=A

$\Gamma((D\bar{D}^*)^\pm)/\Gamma(J/\psi \pi)$						Γ_5/Γ_1
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
6.2 ± 1.1 ± 2.7		¹ ABLIKIM	14A	BES3	\pm	$e^+ e^- \rightarrow \pi^\pm (D\bar{D}^*)^\mp$

NODE=M210R03
NODE=M210R03¹ Assuming the same origin of the $(D\bar{D}^*)^\pm$ and $\pi^\pm J/\psi$ decay modes.

NODE=M210R03;LINKAGE=A

$\Gamma(D^0 D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$						Γ_6/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
seen		ABLIKIM	15AC	BES3	\pm	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$
seen		ABLIKIM	14A	BES3	\pm	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$

NODE=M210R09
NODE=M210R09

$\Gamma(D^- D^{*0} + \text{c.c.})/\Gamma_{\text{total}}$						Γ_7/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
seen		ABLIKIM	15AC	BES3	\pm	$e^+ e^- \rightarrow \pi^+ D^- D^{*0} + \text{c.c.}$
seen		ABLIKIM	14A	BES3	\pm	$e^+ e^- \rightarrow \pi^+ D^- D^{*0} + \text{c.c.}$

NODE=M210R10
NODE=M210R10

$\Gamma(\omega \pi^\pm)/\Gamma_{\text{total}}$						Γ_8/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
not seen		ABLIKIM	15R	BES3	\pm	$e^+ e^- \rightarrow \omega \pi^+ \pi^-$

NODE=M210R00
NODE=M210R00

$\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$						Γ_9/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
not seen		ABLIKIM	15Q	BES3	0	4.0–4.6 $e^+ e^- \rightarrow J/\psi \eta \pi^0$

NODE=M210R04
NODE=M210R04

$\Gamma(J/\psi\eta)/\Gamma(J/\psi\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.15	90	ABLIKIM	15Q	BES3	0	4.226 $e^+e^- \rightarrow J/\psi\eta\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<0.65	90	ABLIKIM	15Q	BES3	0	4.257 $e^+e^- \rightarrow J/\psi\eta\pi^0$

NODE=M210R05
NODE=M210R05

OCCUR=2

 $\Gamma(D^+D^{*-} + c.c.)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$

NODE=M210R06
NODE=M210R06 $\Gamma(D^0\bar{D}^{*0} + c.c.)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$

NODE=M210R07
NODE=M210R07 $\Gamma(D^+D^{*-} + c.c.)/\Gamma(D^0\bar{D}^{*0} + c.c.)$ Γ_{10}/Γ_{11}

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.96±0.18±0.12	ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$

NODE=M210R08
NODE=M210R08 $T_{c\bar{c}1}(3900)$ REFERENCES

ABLIKIM	20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=60338
ABAZOV	19	PR D100 012005	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=59903
ABLIKIM	19BC	PR D100 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60036
ABAZOV	18B	PR D98 052010	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=59442
ABLIKIM	17J	PRL 119 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=57950
ABLIKIM	15AB	PRL 115 222002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56954
ABLIKIM	15AC	PR D92 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=56967
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56782
ABLIKIM	15R	PR D92 032009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56783
ABLIKIM	15U	PRL 115 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56786
ADOLPH	15D	PL B742 330	C. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56791
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
Also		JHEP 1702 088 (errata)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)	REFID=57795
ABLIKIM	14A	PRL 112 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=55648
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55409
ABLIKIM	13X	PRL 111 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55635
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=55410
XIAO	13A	PL B727 366	T. Xiao <i>et al.</i>	(NWES)	REFID=55593

NODE=M210

NODE=M259

 $T_{c\bar{c}1}(4000)$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

was $Z_{c\bar{c}S}(4000)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M259

Seen by AAIJ 21E in $B^+ \rightarrow T_{c\bar{c}1}(4000)^+ \phi$ with $T_{c\bar{c}1}(4000)^+ \rightarrow J/\psi K^+$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 15σ . The $J^P = 1^+$ assignment is favored with high significance. ABLIKIM 21G also reports a $J^P = 1^+ Z_{c\bar{c}S}$ state in this mass region using $e^+e^- \rightarrow K^+(D_s^- D^{*0} + D_s^{*-} D^0)$ with a significance of 5.3σ . The incompatible values for the widths reported by AAIJ 21E and ABLIKIM 21G could either indicate the existence of two separate states or possibly be explained in a coupled channel model (see ORTEGA 21).

 $T_{c\bar{c}1}(4000)$ MASS

NODE=M259M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3980-4010 OUR EVALUATION				
3988 ± 5 OUR AVERAGE Error includes scale factor of 2.7.				
3991	$^{+12}_{-10} \quad ^{+9}_{-17}$	1 AAIJ	23AQ LHCB	$B^0 \rightarrow J/\psi \phi K_S^0$
3992.2 ± 1.7 ± 1.6		2 ABLIKIM	22AE BES3	$e^+e^- \rightarrow K_S^0(D_s^- D^{*+} + D_s^{*-} D^+)$
4003 ± 6	$^{+4}_{-14}$	24k	3 AAIJ	21E LHCB $B^+ \rightarrow J/\psi \phi K^+$
3982.5	$^{+1.8}_{-2.6} \pm 2.1$	4 ABLIKIM	21G BES3	$e^+e^- \rightarrow K^+(D_s^- D^{*0} + D_s^{*-} D^0)$

NODE=M259M

→ UNCHECKED ←

- ¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0σ . The mass difference with respect to the charged partner in AAIJ 21E is -12^{+11+6}_{-10-4} MeV.
- ² Pole mass for a mass-, width-dependent Breit-Wigner fit to the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6σ .
- ³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15σ .
- ⁴ Pole mass for a mass-dependent Breit-Wigner fit to the mass spectrum recoiling against K^+ at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3σ .

NODE=M259M;LINKAGE=E

NODE=M259M;LINKAGE=D

NODE=M259M;LINKAGE=A

NODE=M259M;LINKAGE=B

 $T_{c\bar{c}s1}(4000)$ WIDTH

NODE=M259W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M259W

5-150 OUR EVALUATION

→ UNCHECKED ←

14 ± 4 OUR AVERAGE		Error includes scale factor of 1.1.		
105	$+29^{+17}_{-25-23}$	¹ AAIJ	23AQ LHCB	$B^0 \rightarrow J/\psi \phi K_S^0$
	$7.7^{+4.1}_{-3.8} \pm 4.3$	² ABLIKIM	22AE BES3	$e^+ e^- \rightarrow K_S^0 (D_s^- D^{*+} + D_s^{*-} D^+)$
131	$\pm 15 \pm 26$	³ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
	$12.8^{+5.3}_{-4.4} \pm 3.0$	⁴ ABLIKIM	21G BES3	$e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$

- ¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0σ .
- ² Pole width for a mass-, width-dependent Breit-Wigner fit to the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6σ .
- ³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15σ .
- ⁴ Pole width for a mass-dependent Breit-Wigner fit to the mass spectrum recoiling against K^+ at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3σ .

NODE=M259W;LINKAGE=D

NODE=M259W;LINKAGE=C

NODE=M259W;LINKAGE=A

NODE=M259W;LINKAGE=B

 $T_{c\bar{c}s1}(4000)$ DECAY MODES

NODE=M259215;NODE=M259

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi K^+$	seen
Γ_2 $J/\psi K_S^0$	seen
Γ_3 $D_s^+ \bar{D}^{*0}$ or $D_s^{*+} \bar{D}^0$	seen
Γ_4 $D_s^+ D^{*-}$ or $D_s^{*+} D^-$	seen

DESIG=1

DESIG=4

DESIG=2

DESIG=3

 $T_{c\bar{c}s1}(4000)$ BRANCHING RATIOS

NODE=M259225

$\Gamma(J/\psi K^+)/\Gamma_{\text{total}}$	Γ_1/Γ
--	-------------------

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M259R01

NODE=M259R01

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15σ .

NODE=M259R01;LINKAGE=A

$\Gamma(J/\psi K_S^0)/\Gamma_{\text{total}}$	Γ_2/Γ
--	-------------------

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	23AQ LHCB	$B^0 \rightarrow J/\psi \phi K_S^0$

NODE=M259R02

NODE=M259R02

- ¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0σ .

NODE=M259R02;LINKAGE=A

$\Gamma(D_s^+ \bar{D}^{*0}$ or $D_s^{*+} \bar{D}^0)/\Gamma_{\text{total}}$	Γ_3/Γ
--	-------------------

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	21G BES3	$e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$

NODE=M259R00

NODE=M259R00

- ¹ Seen in the spectrum recoiling against K^+ in $e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$ collisions at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3σ .

NODE=M259R00;LINKAGE=A

$\Gamma(J/\psi K^+)/\Gamma(D_s^+ \bar{D}^{*0}$ or $D_s^{*+} \bar{D}^0)$	Γ_1/Γ_3
---	---------------------

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.03	90	ABLIKIM	23BI BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$

NODE=M259R04

NODE=M259R04

$$\Gamma(D_s^+ D^{*-} \text{ or } D_s^{*+} D^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	22AE BES3	$e^+ e^- \rightarrow K_S^0 (D_s^- D^{*+} + D_s^{*-} D^+)$

¹ Seen in the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6 σ .

NODE=M259R03
NODE=M259R03

NODE=M259R03;LINKAGE=A

$T_{c\bar{c}1}(4000)$ REFERENCES

AAIJ	23AQ PRL 131 131901	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62429
ABLIKIM	23BI PRL 131 211902	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62434
ABLIKIM	22AE PRL 129 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61877
AAIJ	21E PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=61150
ABLIKIM	21G PRL 126 102001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61065
ORTEGA	21 PL B818 136382	P.G. Ortega, D.R. Entem, F. Fernandez		REFID=61108

NODE=M259

NODE=M213

$T_{c\bar{c}}(4020)$

$$I^G(J^{PC}) = 1^+(?^-)$$

was $X(4020)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M213

Charged $T_{c\bar{c}}(4020)$ seen by ABLIKIM 13X from $e^+ e^- \rightarrow \pi^+ \pi^- h_c(1P)$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $\pi^\pm h_c(1P)$ system, and by ABLIKIM 14B from $e^+ e^- \rightarrow (D^* \bar{D}^*)^\pm \pi^\mp$ events in $(D^* \bar{D}^*)^\pm$ mass. A neutral $T_{c\bar{c}}(4020)$ seen by ABLIKIM 14P at three c.m. energies in the same range in $e^+ e^- \rightarrow \pi^0 \pi^0 h_c(1P)$ as a peak in the larger of the two masses recoiling against a π^0 . ABLIKIM 15AA observes a 5.9 σ signal in $(D^* \bar{D}^*)^0$ in $e^+ e^- \rightarrow (D^* \bar{D}^*)^0 \pi^0$ events using collisions at two c.m. energies. Production rates and mass values support grouping neutral and charged $T_{c\bar{c}}(4020)$ together as manifestations of a single $I = 1$ particle.

$T_{c\bar{c}}(4020)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
4024.1 \pm 1.9 OUR AVERAGE					
4025.5 ^{+2.0} _{-4.7} \pm 3.1	116	¹ ABLIKIM	15AA BES3	0	$e^+ e^- \rightarrow (D^* \bar{D}^*)^0 \pi^0$
4026.3 \pm 2.6 \pm 3.7	401	¹ ABLIKIM	14B BES3	\pm	$e^+ e^- \rightarrow (D^* \bar{D}^*)^\pm \pi^\mp$
4023.9 \pm 2.2 \pm 3.8	61	^{1,2} ABLIKIM	14P BES3	0	$e^+ e^- \rightarrow \pi^0 \pi^0 h_c$
4022.9 \pm 0.8 \pm 2.7	253	¹ ABLIKIM	13X BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

² Assuming $J^P = 1^+$ and width of 7.9 ± 2.6 MeV.

NODE=M213M

NODE=M213M

NODE=M213M;LINKAGE=AB

NODE=M213M;LINKAGE=B

$T_{c\bar{c}}(4020)$ WIDTH

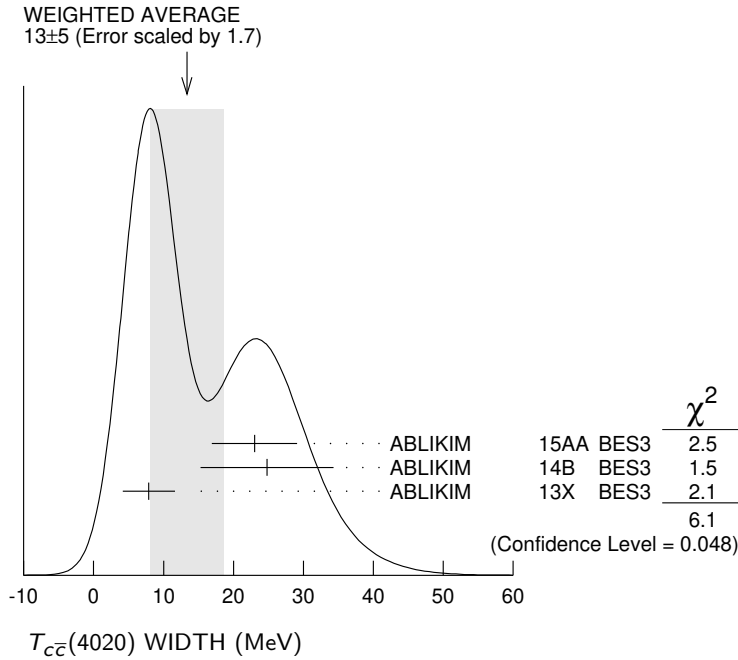
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
13 \pm 5 OUR AVERAGE					Error includes scale factor of 1.7. See the ideogram below.
23.0 \pm 6.0 \pm 1.0	116	¹ ABLIKIM	15AA BES3	0	$e^+ e^- \rightarrow (D^* \bar{D}^*)^0 \pi^0$
24.8 \pm 5.6 \pm 7.7	401	¹ ABLIKIM	14B BES3	\pm	$e^+ e^- \rightarrow (D^* \bar{D}^*)^\pm \pi^\mp$
7.9 \pm 2.7 \pm 2.6	253	¹ ABLIKIM	13X BES3	\pm	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

NODE=M213W

NODE=M213W

NODE=M213W;LINKAGE=AB



$T_{c\bar{c}}(4020)$ DECAY MODES

NODE=M213215;NODE=M213

Mode	Fraction (Γ_i/Γ)
Γ_1 $h_c(1P)\pi$	seen
Γ_2 $D^*\bar{D}^*$	seen
Γ_3 $D\bar{D}^* + \text{c.c.}$	not seen
Γ_4 $\eta_c\pi^+\pi^-$	not seen
Γ_5 $\eta_c(1S)\rho(770)^\pm$	
Γ_6 $J/\psi(1S)\pi^\pm$	not seen

DESIG=1

DESIG=2

DESIG=4

DESIG=3

DESIG=6

DESIG=5

$T_{c\bar{c}}(4020)$ BRANCHING RATIOS

NODE=M213225

$\Gamma(h_c(1P)\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT	
seen	61	ABLIKIM 14P	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 h_c$	
seen	253	ABLIKIM 13X	BES3	\pm	$e^+e^- \rightarrow \pi^+\pi^- h_c$	

NODE=M213R01
NODE=M213R01

$\Gamma(D^*\bar{D}^*)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT	
seen	116	¹ ABLIKIM 15AA	BES3	0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$	
seen	401	¹ ABLIKIM 14B	BES3	\pm	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$	

NODE=M213R02
NODE=M213R02¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

NODE=M213R02;LINKAGE=A

$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
not seen		ABLIKIM 15AC	BES3	\pm	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$	

NODE=M213R03
NODE=M213R03

$\Gamma(\eta_c\pi^+\pi^-)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE		DOCUMENT ID	TECN		COMMENT	
not seen		¹ VINOKUROVA 15	BELL		$B^+ \rightarrow K^+\eta_c\pi^+\pi^-$	

NODE=M213R00
NODE=M213R00¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+T_{c\bar{c}}(4020)^0) \times B(T_{c\bar{c}} \rightarrow \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ at 90% CL.

NODE=M213R00;LINKAGE=VI

$\Gamma(\eta_c(1S)\rho(770)^\pm)/\Gamma(h_c(1P)\pi)$						Γ_5/Γ_1
VALUE	CL%	DOCUMENT ID	TECN		COMMENT	
<1.2	90	¹ ABLIKIM 19BC	BES3		$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c(1S)$	

NODE=M213R05
NODE=M213R05¹ Using $e^+e^- \rightarrow \pi^\mp(Z_c(4020)^\pm \rightarrow h_c(1P)\pi^\pm)$ cross section at 4.23, 4.26 and 4.36 GeV from ABLIKIM 13X.

NODE=M213R05;LINKAGE=A

$\Gamma(J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 17J BES3		$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ From Partial Wave Analysis assuming $J^P = 1^+$.NODE=M213R04
NODE=M213R04

NODE=M213R04;LINKAGE=A

 $T_{c\bar{c}}(4020)$ REFERENCES

ABLIKIM 19BC PR D100 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17J PRL 119 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 15AA PRL 115 182002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 15AC PR D92 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
VINOKUROVA 15 JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
Also JHEP 1702 088 (errata.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)
ABLIKIM 14B PRL 112 132001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 14P PRL 113 212002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 13X PRL 111 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)

NODE=M213

REFID=60036
REFID=57950
REFID=56951
REFID=56967
REFID=56706
REFID=57795
REFID=55654
REFID=56118
REFID=55635

NODE=M191

 $T_{c\bar{c}}(4050)^+$ $I^G(J^{PC}) = 1^-(?^?+)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $X(4050)$ Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M191

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure. $T_{c\bar{c}}(4050)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4051 \pm 14^{+20}_{-41}$	¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191M

NODE=M191M

NODE=M191M;LINKAGE=MI

 $T_{c\bar{c}}(4050)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
82^{+21+47}_{-17-22}	¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191W

NODE=M191W

NODE=M191W;LINKAGE=MI

 $T_{c\bar{c}}(4050)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^+\chi_{c1}(1P)$	seen
$\Gamma_2 \pi^\pm\psi(3770)$	not seen
$\Gamma_3 \pi^\pm\chi_{c0}(1P)$	not seen
$\Gamma_4 \pi^\pm\chi_{c2}(1P)$	not seen

NODE=M191215;NODE=M191

DESIG=1

DESIG=2

DESIG=3

DESIG=4

 $T_{c\bar{c}}(4050)^+$ BRANCHING RATIOS $\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen		¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

••• We do not use the following data for averages, fits, limits, etc. •••

not seen 16 ² ABLIKIM 21W BES3 $e^+e^- \rightarrow \chi_{cJ}\pi^+\pi^+$ not seen ³ LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$ ¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-T_{c\bar{c}}(4050)^+) \times B(T_{c\bar{c}}(4050)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.² ABLIKIM 21W measurement is limited by statistics.³ With a product branching fraction limit of $B(\bar{B}^0 \rightarrow T_{c\bar{c}}(4050)^+K^-) \times B(T_{c\bar{c}}(4050)^+ \rightarrow \chi_{c1}\pi^+) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M191225

NODE=M191R01
NODE=M191R01

NODE=M191R01;LINKAGE=MI

NODE=M191R01;LINKAGE=A

NODE=M191R01;LINKAGE=LE

$\Gamma(\pi^\pm \chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVT	DOCUMENT ID	TECN	COMMENT
not seen	18	¹ ABLIKIM	21W BES3	$e^+e^- \rightarrow \chi_{cJ}\pi^+\pi^+$

¹ ABLIKIM 21W measurement is limited by statistics.

NODE=M191R02
NODE=M191R02

NODE=M191R02;LINKAGE=A

 $\Gamma(\pi^\pm \chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVT	DOCUMENT ID	TECN	COMMENT
not seen	14	¹ ABLIKIM	21W BES3	$e^+e^- \rightarrow \chi_{cJ}\pi^+\pi^+$

¹ ABLIKIM 21W measurement is limited by statistics.

NODE=M191R03
NODE=M191R03

NODE=M191R03;LINKAGE=A

 $\Gamma(\pi^\pm \psi(3770))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$

¹ From a measurement of $\sigma(e^+e^- \rightarrow \pi^+\pi^-D\bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.

NODE=M191R00
NODE=M191R00

NODE=M191R00;LINKAGE=A

 $T_{c\bar{c}}(4050)^+$ REFERENCES

ABLIKIM	21W	PR D103 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M191

REFID=61221
REFID=59910
REFID=54042
REFID=52535

NODE=M223

$T_{c\bar{c}}(4055)^+$

$I^G(J^{PC}) = 1^+(?^-)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE
was $X(4055)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M223

Needs confirmation. Seen by WANG 15A in the $\psi(2S)\pi^+$ invariant mass distribution in $\psi(4360) \rightarrow \psi(2S)\pi^+\pi^-$ decay.

 $T_{c\bar{c}}(4055)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4054 ± 3 ± 1	¹ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
4039.3 ± 6.0	² ABLIKIM	18K BES3	$e^+e^- \rightarrow \pi^0\pi^0\psi(2S)$
4032.1 ± 2.4	³ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$

••• We do not use the following data for averages, fits, limits, etc. •••

¹ Statistical significance of 3.5 σ .

² Statistical error only, with significance of 5.9 σ (from a fit with a 19% CL). Identified as the same structure observed in ABLIKIM 17V in $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ decays.

³ Statistical error only, with significance of 9.2 σ . From an unbinned maximum likelihood fit of the $\pi^+\pi^-\psi(2S)$ Dalitz plot from data collected at $\sqrt{s} = 4.416$ GeV for a $J^C = 1^+$ state. The fit does not match the detailed structure of the data, having a C.L. of only 8%.

NODE=M223M

NODE=M223M

OCCUR=2

NODE=M223M;LINKAGE=A

NODE=M223M;LINKAGE=C

NODE=M223M;LINKAGE=B

 $T_{c\bar{c}}(4055)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
45 ± 11 ± 6	¹ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
31.9 ± 14.8	² ABLIKIM	18K BES3	$e^+e^- \rightarrow \pi^0\pi^0\psi(2S)$
26.1 ± 5.3	³ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$

••• We do not use the following data for averages, fits, limits, etc. •••

¹ Statistical significance of 3.5 σ .

² Statistical error only, with significance of 5.9 σ (from a fit with a 19% CL). Identified as the same structure observed in ABLIKIM 17V in $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ decays.

³ Statistical error only, with significance of 9.2 σ . From an unbinned maximum likelihood fit of the $\pi^+\pi^-\psi(2S)$ Dalitz plot from data collected at $\sqrt{s} = 4.416$ GeV for a $J^C = 1^+$ state. The fit does not match the detailed structure of the data, having a C.L. of only 8%.

NODE=M223W

NODE=M223W

NODE=M223W;LINKAGE=A

NODE=M223W;LINKAGE=C

NODE=M223W;LINKAGE=B

$T_{c\bar{c}}(4055)^+$ DECAY MODES

NODE=M223215;NODE=M223

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+ \psi(2S)$	seen
Γ_2 $\pi^\pm \psi(3770)$	not seen

DESIG=1

DESIG=2

 $T_{c\bar{c}}(4055)^+$ BRANCHING RATIOS

NODE=M223225

$\Gamma(\pi^+ \psi(2S))/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ WANG	15A	BELL 10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

NODE=M223R01
NODE=M223R01¹ Statistical significance of 3.5 σ .

NODE=M223R01;LINKAGE=A

$\Gamma(\pi^\pm \psi(3770))/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	19AR	BES3 $e^+ e^- \rightarrow \pi^+ \pi^- D\bar{D}$

NODE=M223R00
NODE=M223R00¹ From a measurement of $\sigma(e^+ e^- \rightarrow \pi^+ \pi^- D\bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.

NODE=M223R00;LINKAGE=A

 $T_{c\bar{c}}(4055)^+$ REFERENCES

NODE=M223

ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18K	PR D97 052001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)

REFID=59910
REFID=58896
REFID=58029
REFID=59611
REFID=56839

NODE=M240

 $T_{c\bar{c}}(4100)^+$

$$I^G(J^{PC}) = 1^-(?^{?+})$$

OMITTED FROM SUMMARY TABLE
was $X(4100)^\pm$ Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M240

Reported by AAIJ 18AN in the $\eta_c(1S)\pi^-$ invariant mass distribution in $B^0 \rightarrow \eta_c(1S)K^+\pi^-$ decays with a significance of 3.4 σ . $J^P = 0^+$ or 1^- assignment consistent with data. **$T_{c\bar{c}}(4100)^+$ MASS**

NODE=M240M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4096 \pm 20^{+18}_{-22}$	AAIJ	18AN	LHCB $B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240M

 $T_{c\bar{c}}(4100)^+$ WIDTH

NODE=M240W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$152 \pm 58^{+60}_{-35}$	AAIJ	18AN	LHCB $B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240W

 $T_{c\bar{c}}(4100)^+$ DECAY MODES

NODE=M240215;NODE=M240

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta_c(1S)\pi^+$	seen
Γ_2 $\pi^\pm \psi(3770)$	not seen

DESIG=1

DESIG=2

 $T_{c\bar{c}}(4100)^+$ BRANCHING RATIOS

NODE=M240225

$\Gamma(\eta_c(1S)\pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	18AN	LHCB $B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240R01
NODE=M240R01¹ AAIJ 18AN quotes a fit fraction for $B^0 \rightarrow T_{c\bar{c}}(4100)^- K^+ \rightarrow \eta_c(1S)\pi^- K^+$ of $(3.3 \pm 1.1^{+1.2}_{-1.1})\%$ from an amplitude analysis.

NODE=M240R01;LINKAGE=A

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^- D\bar{D}$

¹ From a measurement of $\sigma(e^+e^- \rightarrow \pi^+\pi^- D\bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.

NODE=M240R00
 NODE=M240R00

NODE=M240R00;LINKAGE=A

 $T_{c\bar{c}}(4100)^+$ REFERENCES

ABLIKIM	19AR PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	18AN EPJ C78 1019	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M240

REFID=59910
 REFID=59335

NODE=M231

$T_{c\bar{c}1}(4200)^+$

$I^G(J^{PC}) = 1^+(1^{+-})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $Z_c(4200), X(4200)^\pm$

This state shows properties different from a conventional $q\bar{q}$ state.
 A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M231

Reported by CHILIKIN 14 in $J/\psi\pi^+$ at a significance of 6.2σ . Assignments of $0^-, 1^-, 2^-,$ and 2^+ excluded at $6.1\sigma, 7.4\sigma, 4.4\sigma,$ and 7.0σ level, respectively. Needs confirmation.

 $T_{c\bar{c}1}(4200)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4196^{+31+17}_{-29-13}	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231M

NODE=M231M

 $T_{c\bar{c}1}(4200)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$370 \pm 70^{+70}_{-132}$	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231W

NODE=M231W

 $T_{c\bar{c}1}(4200)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\pi^+$	seen

NODE=M231215;NODE=M231

DESIG=1

 $T_{c\bar{c}1}(4200)^+$ BRANCHING RATIOS $\Gamma(J/\psi\pi^+)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen ¹ AAIJ 19R LHCb $B^0 \rightarrow K^+ \pi^- J/\psi + \text{c.c.}$

¹ From a model-independent analysis.

NODE=M231R01
 NODE=M231R01

NODE=M231R01;LINKAGE=C

 $T_{c\bar{c}1}(4200)^+$ REFERENCES

AAIJ	19R PRL 122 152002	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHILIKIN	14 PR D90 112009	K. Chilikin <i>et al.</i>	(BELLE Collab.)

NODE=M231

REFID=59776
 REFID=56344

NODE=M260

 $T_{c\bar{c}s1}(4220)^+$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

was $Z_{cs}(4220)^+$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M260

Seen by AAIJ 21E in $B^+ \rightarrow T_{c\bar{c}s1}(4220)^+ \phi$ with $T_{c\bar{c}s1}(4220)^+ \rightarrow J/\psi K^+$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 5.9σ . The $J^P = 1^+$ assignment is favored over 1^- with a significance of 2σ and other assignments are disfavored by 4.9σ .

 $T_{c\bar{c}s1}(4220)^+$ MASS

NODE=M260M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4216 \pm 24^{+43}_{-30}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M260M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260M;LINKAGE=A

 $T_{c\bar{c}s1}(4220)^+$ WIDTH

NODE=M260W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$233 \pm 52^{+97}_{-73}$	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M260W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260W;LINKAGE=A

 $T_{c\bar{c}s1}(4220)^+$ DECAY MODES

NODE=M260215;NODE=M260

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi K^+$	seen

DESIG=1

 $T_{c\bar{c}s1}(4220)^+$ BRANCHING RATIOS

NODE=M260225

$\Gamma(J/\psi K^+)/\Gamma_{\text{total}}$	Γ_1/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M260R01
NODE=M260R01

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260R01;LINKAGE=A

 $T_{c\bar{c}s1}(4220)^+$ REFERENCES

NODE=M260

AAIJ 21E PRL 127 082001 R. Aaij et al. (LHCb Collab.) JP

REFID=61150

$T_{c\bar{c}0}(4240)^+$
 $I^G(J^{PC}) = 1^+(0^{--})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $R_{c0}(4240)$, $X(4240)^\pm$ Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.Spin and parity assignment $J^P = 0^-$ is favored over 1^- , 2^- , and 2^+ by 8σ and over 1^+ by 1σ , according to the four-dimensional amplitude analysis of AAIJ 14AG.

NODE=M216

NODE=M216

 $T_{c\bar{c}0}(4240)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4239 \pm 18^{+45}_{-10}$	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^- \pi^+ \psi(2S)$

NODE=M216M

NODE=M216M

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216M;LINKAGE=AA

 $T_{c\bar{c}0}(4240)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$220 \pm 47^{+108}_{-74}$	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^- \pi^+ \psi(2S)$

NODE=M216W

NODE=M216W

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216W;LINKAGE=AA

 $T_{c\bar{c}0}(4240)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \psi(2S)$	seen

NODE=M216215;NODE=M216

DESIG=1

 $T_{c\bar{c}0}(4240)^+$ BRANCHING RATIOS

$\Gamma(\pi^+ \psi(2S))/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^- \pi^+ \psi(2S)$

NODE=M216225

NODE=M216R01
NODE=M216R01¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit. No partial branching fraction quoted.

NODE=M216R01;LINKAGE=AA

 $T_{c\bar{c}0}(4240)^+$ REFERENCES

AAIJ	14AG PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.)
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NODE=M216

REFID=55896

$T_{c\bar{c}}(4250)^+$
 $I^G(J^{PC}) = 1^-(?^{?+})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $X(4250)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure.

NODE=M192

NODE=M192

 $T_{c\bar{c}}(4250)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4248^{+44+180}_{-29-35}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192M

NODE=M192M

NODE=M192M;LINKAGE=MI

 $T_{c\bar{c}}(4250)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$177^{+54+316}_{-39-61}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192W

NODE=M192W

NODE=M192W;LINKAGE=MI

 $T_{c\bar{c}}(4250)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

NODE=M192215;NODE=M192

DESIG=1

 $T_{c\bar{c}}(4250)^+$ BRANCHING RATIOS
 $\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

••• We do not use the following data for averages, fits, limits, etc. •••

not seen ² LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$

¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}}(4250)^+) \times B(T_{c\bar{c}}(4250)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.

² With a product branching fraction limit of $B(\bar{B}^0 \rightarrow T_{c\bar{c}}(4250)^+ K^-) \times B(T_{c\bar{c}}(4250)^+ \rightarrow \chi_{c1}\pi^+) < 4.0 \times 10^{-5}$ at 90% CL.

NODE=M192225

NODE=M192R01
NODE=M192R01

NODE=M192R01;LINKAGE=MI

NODE=M192R01;LINKAGE=LE

 $T_{c\bar{c}}(4250)^+$ REFERENCES

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M192

REFID=54042
REFID=52535

$T_{c\bar{c}1}(4430)^+$

 $I^G(J^{PC}) = 1^+(1^{+-})$
 G, C need confirmation.
was $Z_c(4430), X(4430)^\pm$ Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

First seen by CHOI 08 in $B \rightarrow K\pi^+\psi(2S)$ decays, confirmed by AAIJ 14AG, and confirmed in a model-independent way by AAIJ 15BH. Also seen by CHILIKIN 14 in $B \rightarrow K^+\pi J/\psi$ decays. J^P was determined by CHILIKIN 13 and AAIJ 14AG.

NODE=M195

NODE=M195

$T_{c\bar{c}1}(4430)^+$ MASS

NODE=M195M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M195M

4478^{+15}_{-18} OUR AVERAGE

$4475 \pm 7^{+15}_{-25}$	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^-\pi^+\psi(2S)$
$4485 \pm 22^{+28}_{-11}$	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4443^{+15+19}_{-12-13}	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
$4433 \pm 4 \pm 2$	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$

¹ From a four-dimensional amplitude analysis.² From a Dalitz plot analysis. Superseded by CHILIKIN 13.³ Superseded by MIZUK 09 and CHILIKIN 13.

NODE=M195M;LINKAGE=A
 NODE=M195M;LINKAGE=MI
 NODE=M195M;LINKAGE=CH

$T_{c\bar{c}1}(4430)^+$ WIDTH

NODE=M195W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
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NODE=M195W

181 ± 31 OUR AVERAGE

$172 \pm 13^{+37}_{-34}$	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^-\pi^+\psi(2S)$
200^{+41+26}_{-46-35}	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

107^{+86+74}_{-43-56}	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
45^{+18+30}_{-13-13}	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$

¹ From a four-dimensional amplitude analysis.² From a Dalitz plot analysis. Superseded by CHILIKIN 13.³ Superseded by MIZUK 09 and CHILIKIN 13.

NODE=M195W;LINKAGE=A
 NODE=M195W;LINKAGE=MI
 NODE=M195W;LINKAGE=CH

$T_{c\bar{c}1}(4430)^+$ DECAY MODES

NODE=M195215;NODE=M195

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\psi(2S)$	seen
$\Gamma_2 \quad \pi^+J/\psi$	seen

DESIG=1

DESIG=2

$T_{c\bar{c}1}(4430)^+$ BRANCHING RATIOS

NODE=M195225

 $\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
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NODE=M195R01
 NODE=M195R01

seen	¹ AAIJ	14AG LHCB	$\bar{B}^0 \rightarrow K^-\pi^+\psi(2S)$
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seen	² CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	³ AUBERT	09AA BABR	$B \rightarrow K\pi^+\psi(2S)$
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seen	⁴ MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
------	--------------------	---------	--------------------------------

¹ From a four-dimensional amplitude analysis. No product of branching fractions quoted.

² From a four-dimensional amplitude analysis. Measured a product of branching fractions

$$B(B^0 \rightarrow T_{c\bar{c}1}(4430)^- K^+) \times B(T_{c\bar{c}1}(4430)^- \rightarrow \psi(2S)\pi^-) = (6.0_{-2.0}^{+1.7+2.5}) \times 10^{-5}$$

³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) < 4.7 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) < 3.1 \times 10^{-5}$ at 95% CL.

⁴ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) = (3.2_{-0.9}^{+1.8+5.3}) \times 10^{-5}$. Superseded by CHILIKIN 13.

NODE=M195R01;LINKAGE=AA
NODE=M195R01;LINKAGE=A

NODE=M195R01;LINKAGE=AU

NODE=M195R01;LINKAGE=MI

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$

Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	1,2 CHILIKIN	14	BELL $\bar{B}^0 \rightarrow K^- \pi^+ J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	³ AUBERT	09AA	BABR $B \rightarrow K \pi^+ J/\psi$
¹ CHILIKIN 14 reports $B(\bar{B}^0 \rightarrow T_{c\bar{c}1}(4430)^+ K^-) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow J/\psi \pi^+) = (5.4_{-1.0}^{+4.0+1.1}) \times 10^{-6}$.			
² A broad enhancement seen by AAIJ 19R in the decays $B^0 \rightarrow J/\psi \pi^+ K^-$ at 4600 MeV can be due to an interplay of $T_{c\bar{c}1}(4430)$, $T_{c\bar{c}1}(4200)$ and the fitting polynomials.			
³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

NODE=M195R02
NODE=M195R02

NODE=M195R02;LINKAGE=A

NODE=M195R02;LINKAGE=E

NODE=M195R02;LINKAGE=AU

$T_{c\bar{c}1}(4430)^+$ REFERENCES

NODE=M195

AAIJ	19R	PRL 122 152002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59776
AAIJ	15BH	PR D92 112009	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57110
AAIJ	14AG	PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=55896
CHILIKIN	14	PR D90 112009	K. Chilikin <i>et al.</i>	(BELLE Collab.)	REFID=56344
CHILIKIN	13	PR D88 074026	K. Chilikin <i>et al.</i>	(BELLE Collab.) JP	REFID=55551
AUBERT	09AA	PR D79 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52940
MIZUK	09	PR D80 031104	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=52960
CHOI	08	PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=52178

NODE=M232

$T_{b\bar{s}}(5568)^+$

$$I(J^P) = 1(?^?)$$

OMITTED FROM SUMMARY TABLE
was $X(5568)^\pm$

Seen as a peak in the $B_s \pi^\pm$ mass spectrum with a significance of more than 3σ by ABAZOV 16E and ABAZOV 18A in inclusive $p\bar{p}$ collisions at 1.96 TeV. Not seen by AAIJ 16AI, AABOUD 18L, AALTONEN 18A, and SIRUNYAN 18J. Needs confirmation.

NODE=M232

$T_{b\bar{s}}(5568)^+$ MASS

NODE=M232M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$5566.9_{-3.1}^{+3.2+0.6}$	278	¹ ABAZOV	18A	D0 $\rho\bar{p} \rightarrow B_s^0 \pi^\pm X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$5567.8 \pm 2.9_{-1.9}^{+0.9}$	133	² ABAZOV	16E	D0 $\rho\bar{p} \rightarrow B_s^0 \pi^\pm X$

NODE=M232M

¹ From the combined analysis of $B_s^0 \rightarrow J/\psi \phi$ and $B_s^0 \rightarrow D_s^\pm \mu^\mp X$ decays.

² Assumes $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ decay. If $T_{b\bar{s}}(5568)^\pm \rightarrow B_s^* \pi^\pm$ decay is assumed, the mass shifts upward by 49 MeV.

NODE=M232M;LINKAGE=B

NODE=M232M;LINKAGE=A

$T_{b\bar{s}}(5568)^+$ WIDTH

NODE=M232W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$18.6_{-6.1}^{+7.9+3.5}$	278	¹ ABAZOV	18A	D0 $\rho\bar{p} \rightarrow B_s \pi^\pm X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$21.9 \pm 6.4_{-2.5}^{+5.0}$	133	ABAZOV	16E	D0 $\rho\bar{p} \rightarrow B_s \pi^\pm X$

NODE=M232W

¹ From the combined analysis of $B_s^0 \rightarrow J/\psi \phi$ and $B_s^0 \rightarrow D_s^\pm \mu^\mp X$ decays.

NODE=M232W;LINKAGE=B

$T_{b\bar{s}}(5568)^+$ DECAY MODES

NODE=M232215;NODE=M232

Mode	Fraction (Γ_i/Γ)
Γ_1 $B_s \pi^\pm$	seen

DESIG=1

 $T_{b\bar{s}}(5568)^+$ BRANCHING RATIOS

NODE=M232220

$\Gamma(B_s \pi^\pm)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen	145	¹ ABAZOV	18A D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	
seen	133	² ABAZOV	16E D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		³ AABOUD	18L ATLS	$pp \rightarrow B_s^0 \pi^\pm X$	
not seen		⁴ AALTONEN	18A CDF	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	OCCUR=2
not seen		⁵ SIRUNYAN	18J CMS	$pp \rightarrow B_s^0 \pi^\pm X$	
not seen		⁶ AAIJ	16AI LHCB	$pp \rightarrow B_s^0 \pi^\pm X$	

NODE=M232R01
NODE=M232R01¹ With B_s mesons reconstructed in decays to $D_s^\pm \mu^\mp X$.NODE=M232R01;LINKAGE=F
NODE=M232R01;LINKAGE=A² Seen in $p\bar{p}$ collisions at 1.96 TeV at a rate of $(8.6 \pm 1.9 \pm 1.4)\%$ relative to inclusive B_s production in the kinematic region $10 < p_T(B_s) < 30$ GeV/c, with B_s mesons reconstructed in decays to $J/\psi\phi$. An alternative possibility, $T_{b\bar{s}}(5568)^\pm \rightarrow B_s^* \pi^\pm$ with a missing γ , could not be ruled out.³ Not seen in 24.4 fb^{-1} of pp collision data at $\sqrt{s} = 7$ and 8 TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.5% at $p_T(B_s) > 10$ GeV/c and less than 1.6% at $p_T(B_s) > 15$ GeV/c at 95% CL.

NODE=M232R01;LINKAGE=E

⁴ Not seen in 9.6 fb^{-1} of $p\bar{p}$ collision data at $\sqrt{s} = 1.96$ TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 6.7% at 95% CL.

NODE=M232R01;LINKAGE=D

⁵ Not seen in 19.7 fb^{-1} of pp collisions data at $\sqrt{s} = 8$ TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.1% at $p_T(B_s) > 10$ GeV/c and less than 1.0% at $p_T(B_s) > 15$ GeV/c at 95% CL.

NODE=M232R01;LINKAGE=C

⁶ Not seen in 3 fb^{-1} of pp collision data at $\sqrt{s} = 7$ and 8 TeV in a scan over the $T_{b\bar{s}}(5568)$ mass and width, with B_s mesons reconstructed in decays to $D_s^- \pi^+$ or $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 2.1% at $p_T(B_s) > 10$ GeV/c at 90% CL.

NODE=M232R01;LINKAGE=B

 $T_{b\bar{s}}(5568)^+$ REFERENCES

NODE=M232

AABOUD	18L	PRL 120 202007	M. Aaboud <i>et al.</i>	(ATLAS Collab.)
AALTONEN	18A	PRL 120 202006	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	18A	PR D97 092004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
SIRUNYAN	18J	PRL 120 202005	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	16AI	PRL 117 152003	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	16E	PRL 117 022003	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=58829
REFID=58828
REFID=58937
REFID=58827
REFID=57549
REFID=57453

NODE=M268

$T_{cc\bar{c}\bar{c}}(6900)^0$

$I^G(J^{PC}) = 0^+(?^{?+})$

was $X(6900)$

State incompatible with a $q\bar{q}$ structure. See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M268

$T_{cc\bar{c}\bar{c}}(6900)^0$ MASS

NODE=M268M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
6914±11 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below. [6899 ± 12 MeV OUR 2024 AVERAGE Scale factor = 1.1]		
6927 ± 9 ± 4	1 HAYRAPETY...24	CMS	$pp \rightarrow J/\psi J/\psi X$
6910 ± 10 ± 10	2 AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$
6886 ± 11 ± 11	3 AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
6960 ± 50 ± 30	4 AAD	23BL ATLS	$pp \rightarrow J/\psi \psi(2S) X$

NODE=M268M
NEW

1 In a model with three resonances described by interfering relativistic Breit-Wigner functions above background from non-resonant single and double parton scattering and a threshold enhancement. The other two resonances have masses $6652 \pm 10 \pm 12$, $7287^{+20}_{-18} \pm 5$ MeV and widths $124^{+32}_{-26} \pm 33$, $95^{+59}_{-40} \pm 19$ MeV, respectively.

OCCUR=2

NODE=M268M;LINKAGE=D

2 In a model with two resonances, one describing the broad structure above threshold (mass $6650 \pm 20^{+30}_{-20}$ MeV, width $440 \pm 50^{+60}_{-50}$ MeV) interfering with single parton scattering, and a non-interfering $T_{cc\bar{c}\bar{c}}(6900)$.

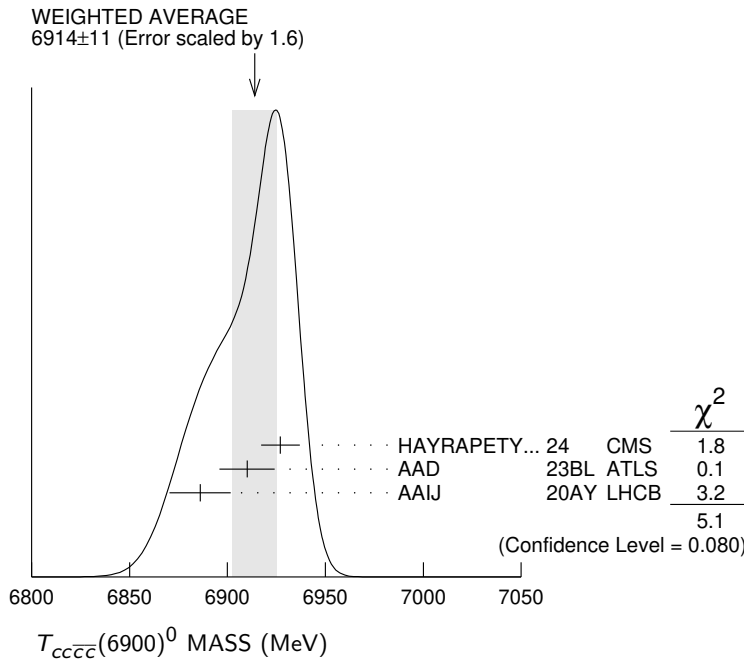
NODE=M268M;LINKAGE=B

3 In a model where the broad structure above threshold interferes with non-resonant single parton scattering. Without interference the mass is $6905 \pm 11 \pm 7$ MeV.

NODE=M268M;LINKAGE=A

4 Assuming a single resonance (could be another state). A 3σ signal is observed for an additional resonance with mass $7220 \pm 30^{+10}_{-40}$ MeV and width $90 \pm 60^{+60}_{-50}$ MeV.

NODE=M268M;LINKAGE=C



$T_{cc\bar{c}\bar{c}}(6900)^0$ WIDTH

NODE=M268W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
137± 21 OUR AVERAGE	[153 ± 29 MeV OUR 2024 AVERAGE]		
122 ⁺ ₋₂₁ ± 18	1 HAYRAPETY...24	CMS	$pp \rightarrow J/\psi J/\psi X$
150 ± 30 ± 10	2 AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$
168 ± 33 ± 69	3 AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
510 ± 170 ⁺ ₋₁₀₀	4 AAD	23BL ATLS	$pp \rightarrow J/\psi \psi(2S) X$

NODE=M268W
NEW

OCCUR=2

- ¹ In a model with three resonances described by interfering relativistic Breit-Wigner functions above background from non-resonant single and double parton scattering and a threshold enhancement. The other two resonances have masses $6652 \pm 10 \pm 12$, $7287^{+20}_{-18} \pm 5$ MeV and widths $124^{+32}_{-26} \pm 33$, $95^{+59}_{-40} \pm 19$ MeV, respectively.
- ² In a model with two resonances, one describing the broad structure above threshold (mass $6650 \pm 20^{+30}_{-20}$ MeV, width $440 \pm 50^{+60}_{-50}$ MeV) interfering with single parton scattering, and a non-interfering $T_{cc\bar{c}\bar{c}}(6900)$.
- ³ In a model where the broad structure above threshold interferes with non-resonant single parton scattering. Without interference the width is 80 ± 38 MeV.
- ⁴ Assuming a single resonance (could be another state). A 3σ signal is observed for an additional resonance with mass $7220 \pm 30^{+10}_{-40}$ MeV and width $90 \pm 60^{+60}_{-50}$ MeV.

NODE=M268W;LINKAGE=E

NODE=M268W;LINKAGE=B

NODE=M268W;LINKAGE=C

NODE=M268W;LINKAGE=D

 $T_{cc\bar{c}\bar{c}}(6900)^0$ DECAY MODES

NODE=M268215;NODE=M268

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi J/\psi$	seen

DESIG=1

 $T_{cc\bar{c}\bar{c}}(6900)^0$ BRANCHING RATIOS

NODE=M268225

$\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	HAYRAPETY...24	CMS	$pp \rightarrow J/\psi J/\psi X$	
seen	AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$	
seen	AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$	

NODE=M268R00
NODE=M268R00 **$T_{cc\bar{c}\bar{c}}(6900)^0$ REFERENCES**

NODE=M268

HAYRAPETY... 24	PRL 132 111901	A. Hayrapetyan <i>et al.</i>	(CMS Collab.)
AAD	23BL PRL 131 151902	G. Aad <i>et al.</i>	(ATLAS Collab.)
AAIJ	20AY SCIB 65 1983	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=62649
REFID=62432
REFID=61631 **$T_{b\bar{b}1}(10610)$**

$$I^G(J^{PC}) = 1^+(1^+ -)$$

NODE=M207

was $Z_b(10610)$, $X(10610)$ Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M207

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses. **$T_{b\bar{b}1}(10610)^\pm$ MASS**

NODE=M207M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2 ± 2.0	¹ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$10608.5 \pm 3.4^{+3.7}_{-1.4}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
$10608.1 \pm 1.2^{+1.5}_{-0.2}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
$10607.4 \pm 1.5^{+0.8}_{-0.2}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
$10611 \pm 4 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
$10609 \pm 2 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
$10608 \pm 2 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
$10605 \pm 2 \pm 3^{+3}_{-1}$	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
$10599 \pm 6 \pm 3^{+5}_{-4}$	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207M

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.² Correlated with the corresponding result from BONDAR 12.³ Superseded by the average measurement of BONDAR 12.

NODE=M207M;LINKAGE=BO

NODE=M207M;LINKAGE=A

NODE=M207M;LINKAGE=BN

$T_{b\bar{b}1}(10610)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10609±4±4	¹ KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$

¹ From a simultaneous fit to the KROKOVNY 13 Dalitz analysis of $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$ decays with fixed width $\Gamma(T_{b\bar{b}1}(10610)^0) = 18.4$ MeV.

NODE=M207M0

NODE=M207M0

NODE=M207M0;LINKAGE=A

 $T_{b\bar{b}1}(10610)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4± 2.4	¹ BONDAR 12	BELL	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
18.5± 5.3 ^{+6.1} _{-2.3}	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
20.8± 2.5 ^{+0.3} _{-2.1}	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
18.7± 3.4 ^{+2.5} _{-1.3}	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
22.3± 7.7 ^{+3.0} _{-4.0}	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2± 3.1 ^{+2.0} _{-3.0}	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
17.6± 3.0±3.0	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
11.4 ⁺ ₋ 4.5 ⁺ ₋ 2.1 ⁺ ₋ 3.9 ⁻ ₋ 1.2 ⁻	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 ⁺ ₋ 10 ⁺ ₋ 8 ⁺ ₋ 9 ⁻ ₋ 7 ⁻	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207W

NODE=M207W

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.² Correlated with the corresponding result from BONDAR 12.³ Superseded by the average measurement of BONDAR 12.

NODE=M207W;LINKAGE=BO

NODE=M207W;LINKAGE=A

NODE=M207W;LINKAGE=BN

 $T_{b\bar{b}1}(10610)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\Upsilon(1S)\pi^+$	$(5.4^{+1.9}_{-1.5}) \times 10^{-3}$
Γ_2 $\Upsilon(1S)\pi^0$	not seen
Γ_3 $\Upsilon(2S)\pi^+$	$(3.6^{+1.1}_{-0.8})\%$
Γ_4 $\Upsilon(2S)\pi^0$	seen
Γ_5 $\Upsilon(3S)\pi^+$	$(2.1^{+0.8}_{-0.6})\%$
Γ_6 $\Upsilon(3S)\pi^0$	seen
Γ_7 $h_b(1P)\pi^+$	$(3.5^{+1.2}_{-0.9})\%$
Γ_8 $h_b(2P)\pi^+$	$(4.7^{+1.7}_{-1.3})\%$
Γ_9 $B^+\bar{B}^0$	not seen
Γ_{10} $B^+\bar{B}^{*0} + B^{*+}\bar{B}^0$	$(85.6^{+2.1}_{-2.9})\%$

NODE=M207215;NODE=M207

DESIG=1

DESIG=9

DESIG=2

DESIG=10

DESIG=3

DESIG=11

DESIG=4

DESIG=5

DESIG=8

DESIG=6

 $T_{b\bar{b}1}(10610)$ BRANCHING RATIOS

$\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
5.4±1.6±1.1 -1.3-0.8	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^-B^+\bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

NODE=M207225

NODE=M207R01

NODE=M207R01

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^+\bar{B}^{*0} + \bar{B}^0B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M207R01;LINKAGE=A

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
not seen	KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0\pi^0$

NODE=M207R09

NODE=M207R09

$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$ Γ_3/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

 $3.62^{+0.76+0.79}$
 $-0.59-0.53$ ¹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$
 $\pi^- \bar{B}^0 B^{*+}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen

GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$ ¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.NODE=M207R02
NODE=M207R02

NODE=M207R02;LINKAGE=A

 $\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID TECN COMMENT

seen

¹ KROKOVNY 13 BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^0\pi^0$ ¹ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .NODE=M207R10
NODE=M207R10

NODE=M207R10;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

 $2.15^{+0.55+0.60}$
 $-0.42-0.43$ ¹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$
 $\pi^- \bar{B}^0 B^{*+}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen

GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$ ¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.NODE=M207R03
NODE=M207R03

NODE=M207R03;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

DOCUMENT ID TECN COMMENT

seen

¹ KROKOVNY 13 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^0\pi^0$ ¹ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .NODE=M207R11
NODE=M207R11

NODE=M207R11;LINKAGE=A

 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

 $3.45^{+0.87+0.86}$
 $-0.71-0.63$ ¹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$
 $\pi^- \bar{B}^0 B^{*+}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen

² MIZUK 16 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

seen

³ BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$ ¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.² Using e^+e^- energies near the $\Upsilon(11020)$.³ Using e^+e^- energies near the $\Upsilon(10860)$.NODE=M207R04
NODE=M207R04

NODE=M207R04;LINKAGE=C

NODE=M207R04;LINKAGE=A
NODE=M207R04;LINKAGE=B $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_8/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

 $4.67^{+1.24+1.18}$
 $-1.00-0.89$ ¹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$
 $\pi^- \bar{B}^0 B^{*+}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen

² MIZUK 16 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

seen

³ BONDAR 12 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$ ¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.² Using e^+e^- energies near the $\Upsilon(11020)$.³ Using e^+e^- energies near the $\Upsilon(10860)$.NODE=M207R05
NODE=M207R05

NODE=M207R05;LINKAGE=C

NODE=M207R05;LINKAGE=A
NODE=M207R05;LINKAGE=B $\Gamma(B^+ \bar{B}^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE

DOCUMENT ID TECN COMMENT

not seen

GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$ NODE=M207R08
NODE=M207R08

$$\frac{\Gamma(B^+\bar{B}^{*0}) + \Gamma(B^{*+}\bar{B}^0)}{\Gamma_{\text{total}}} \quad \Gamma_{10}/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$85.6^{+1.5+1.5}_{-2.0-2.1}$	357	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- B^{*+} \bar{B}^0$

NODE=M207R00
NODE=M207R00

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $T_{b\bar{b}1}(10610)$ from BONDAR 12.

NODE=M207R00;LINKAGE=A

$$\frac{\Gamma(B^+\bar{B}^{*0}) + \Gamma(B^{*+}\bar{B}^0)}{\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)} \quad \Gamma_{10}/(\Gamma_1+\Gamma_3+\Gamma_5+\Gamma_7+\Gamma_8)$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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NODE=M207R07
NODE=M207R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.93^{+0.99+1.01}_{-0.69-0.73}$	357	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
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NODE=M207R07;LINKAGE=A

¹ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $T_{b\bar{b}1}(10610)$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$.

$T_{b\bar{b}1}(10610)$ REFERENCES

GARMASH	16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
GARMASH	15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)
KROKOVNY	13	PR D88 052016	P. Krokovny <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

NODE=M207

REFID=57446
REFID=57465
REFID=56811
REFID=55588
REFID=53963

$$T_{b\bar{b}1}(10650)^+$$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

I, G, C need confirmation.

was $Z_b(10650)$, $X(10650)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M208

NODE=M208

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

$T_{b\bar{b}1}(10650)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10652.2 ± 1.5	¹ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M208M

NODE=M208M

• • • We do not use the following data for averages, fits, limits, etc. • • •

$10656.7 \pm 5.0^{+1.1}_{-3.1}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$	
$10650.7 \pm 1.5^{+0.5}_{-0.2}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$	OCCUR=2
$10651.2 \pm 1.0^{+0.4}_{-0.3}$	² GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$	OCCUR=3
$10657 \pm 6 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$	OCCUR=2
$10651 \pm 2 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$	OCCUR=3
$10652 \pm 1 \pm 2$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$	OCCUR=4
$10654 \pm 3 \pm 1_{-2}$	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$	OCCUR=5
$10651 \pm 2 \pm 3_{-3}$	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$	OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M208M;LINKAGE=BO

NODE=M208M;LINKAGE=A

NODE=M208M;LINKAGE=BN

$T_{b\bar{b}1}(10650)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11.5 ± 2.2	¹ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M208W

NODE=M208W

• • • We do not use the following data for averages, fits, limits, etc. • • •

$12.1^{+11.3+}_{-4.8-} \frac{2.7}{0.6}$	² GARMASH	15	BELL	$e^+ e^- \rightarrow \Upsilon(1S) \pi^+ \pi^-$	
$14.2 \pm 3.7 \frac{0.9}{0.4}$	² GARMASH	15	BELL	$e^+ e^- \rightarrow \Upsilon(2S) \pi^+ \pi^-$	OCCUR=2
$9.3 \pm 2.2 \frac{0.3}{0.5}$	² GARMASH	15	BELL	$e^+ e^- \rightarrow \Upsilon(3S) \pi^+ \pi^-$	OCCUR=3
$16.3 \pm 9.8 \frac{6.0}{2.0}$	³ BONDAR	12	BELL	$e^+ e^- \rightarrow \Upsilon(1S) \pi^+ \pi^-$	OCCUR=2
$13.3 \pm 3.3 \frac{4.0}{3.0}$	³ BONDAR	12	BELL	$e^+ e^- \rightarrow \Upsilon(2S) \pi^+ \pi^-$	OCCUR=3
$8.4 \pm 2.0 \pm 2.0$	³ BONDAR	12	BELL	$e^+ e^- \rightarrow \Upsilon(3S) \pi^+ \pi^-$	OCCUR=4
$20.9 \frac{5.4+}{-4.7-} \frac{2.1}{5.7}$	³ BONDAR	12	BELL	$e^+ e^- \rightarrow h_b(1P) \pi^+ \pi^-$	OCCUR=5
$19 \pm 7 \frac{+11}{-7}$	³ BONDAR	12	BELL	$e^+ e^- \rightarrow h_b(2P) \pi^+ \pi^-$	OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M208W;LINKAGE=BO

NODE=M208W;LINKAGE=A

NODE=M208W;LINKAGE=BN

$T_{b\bar{b}1}(10650)^+$ DECAY MODES

NODE=M208215;NODE=M208

$T_{b\bar{b}1}(10650)^-$ decay modes are charge conjugates of the modes below.

NODE=M208

Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad \Upsilon(1S) \pi^+$	$(1.7^{+0.8}_{-0.6}) \times 10^{-3}$	DESIG=1
$\Gamma_2 \quad \Upsilon(2S) \pi^+$	$(1.4^{+0.6}_{-0.4}) \%$	DESIG=2
$\Gamma_3 \quad \Upsilon(3S) \pi^+$	$(1.6^{+0.7}_{-0.5}) \%$	DESIG=3
$\Gamma_4 \quad h_b(1P) \pi^+$	$(8.4^{+2.9}_{-2.4}) \%$	DESIG=4
$\Gamma_5 \quad h_b(2P) \pi^+$	$(15 \pm 4) \%$	DESIG=5
$\Gamma_6 \quad B^+ \bar{B}^0$	not seen	DESIG=8
$\Gamma_7 \quad B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$	not seen	DESIG=6
$\Gamma_8 \quad B^{*+} \bar{B}^{*0}$	$(74 \frac{+4}{-6}) \%$	DESIG=7

$T_{b\bar{b}1}(10650)^+$ BRANCHING RATIOS

NODE=M208225

$\Gamma(\Upsilon(1S) \pi^+)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT		
$1.7^{+0.7+0.3}_{-0.6-0.2}$	¹ GARMASH	16	BELL $e^+ e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$		

NODE=M208R01

NODE=M208R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL	$e^+ e^- \rightarrow \Upsilon(1S) \pi^+ \pi^-$
seen	BONDAR	12	BELL	$e^+ e^- \rightarrow \Upsilon(1S) \pi^+ \pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R01;LINKAGE=A

$\Gamma(\Upsilon(2S) \pi^+)/\Gamma_{\text{total}}$				Γ_2/Γ	
VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT		
$1.39^{+0.48+0.34}_{-0.38-0.23}$	¹ GARMASH	16	$e^+ e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$		

NODE=M208R02

NODE=M208R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL	$e^+ e^- \rightarrow \Upsilon(2S) \pi^+ \pi^-$
seen	BONDAR	12	BELL	$e^+ e^- \rightarrow \Upsilon(2S) \pi^+ \pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R02;LINKAGE=A

$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ Γ_3/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

$$1.63^{+0.53+0.39}_{-0.42-0.28}$$

1 GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen

GARMASH 15 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

seen

BONDAR 12 BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R03
NODE=M208R03

NODE=M208R03;LINKAGE=A

 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

$$8.41^{+2.43+1.49}_{-2.12-1.06}$$

1 GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen

2 MIZUK 16 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

seen

3 BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R04
NODE=M208R04

NODE=M208R04;LINKAGE=C

NODE=M208R04;LINKAGE=A
NODE=M208R04;LINKAGE=B $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-2})

DOCUMENT ID TECN COMMENT

$$14.7^{+3.2+2.8}_{-2.8-2.3}$$

1 GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen

2 MIZUK 16 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

seen

3 BONDAR 12 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R05
NODE=M208R05

NODE=M208R05;LINKAGE=C

NODE=M208R05;LINKAGE=A
NODE=M208R05;LINKAGE=B $\Gamma(B^+\bar{B}^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

DOCUMENT ID TECN COMMENT

not seen

GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$ NODE=M208R08
NODE=M208R08 $[\Gamma(B^+\bar{B}^{*0}) + \Gamma(B^{*+}\bar{B}^0)]/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE

DOCUMENT ID TECN COMMENT

not seen

GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$ NODE=M208R00
NODE=M208R00 $\Gamma(B^{*+}\bar{B}^{*0})/\Gamma_{\text{total}}$ Γ_8/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID TECN COMMENT

$$73.7^{+3.4+2.7}_{-4.4-3.5}$$

161

1 GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $T_{b\bar{b}1}(10650)$ from BONDAR 12.

NODE=M208R06
NODE=M208R06

NODE=M208R06;LINKAGE=A

 $\Gamma(B^{*+}\bar{B}^{*0})/[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) +$ $\Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)]$ $\Gamma_8/(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4+\Gamma_5)$ VALUE (units 10^{-2})

EVTS

DOCUMENT ID TECN COMMENT

$$2.80^{+0.69+0.54}_{-0.40-0.36}$$

161

1 GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

¹ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $T_{b\bar{b}1}(10650)$ branching fractions to $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$.

NODE=M208R07
NODE=M208R07

NODE=M208R07;LINKAGE=A

 $T_{b\bar{b}1}(10650)^+$ REFERENCES

NODE=M208

GARMASH	16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
GARMASH	15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

REFID=57446
REFID=57465
REFID=56811
REFID=53963

Further States

OMITTED FROM SUMMARY TABLE

This section contains states observed by a single group or states poorly established that thus need confirmation.

QUANTUM NUMBERS, MASSES, WIDTHS, AND BRANCHING RATIOS

X(360) $I^G(J^{PC}) = \text{?}^?(?\text{?}^+)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$360 \pm 7 \pm 9$	64 ± 18	2.3k	¹ ABRAAMYAN 09	CNTR	$2.75 d C \rightarrow \gamma \gamma X$

¹ Not seen in $p C \rightarrow \gamma \gamma X$ at 5.5 GeV/c.

NODE=M300

NODE=M300

NODE=M300K08
NODE=M300K08

NODE=M300K08;LINKAGE=AB

X(1070) $I^G(J^{PC}) = \text{?}^?(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID		COMMENT
1072 ± 1	3.5 ± 0.5		¹ VLADIMIRSK...08		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

¹ Supersedes GRIGOR'EV 05.

NODE=M300J07
NODE=M300J07

NODE=M300J07;LINKAGE=VL

X(1110) $I^G(J^{PC}) = 0^+(\text{even}^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1107 ± 4	$111 \pm 8 \pm 15$		DAFTARI	87	DBC $0. \bar{p} n \rightarrow \rho^- \pi^+ \pi^-$

NODE=M300J30
NODE=M300J30

f₀(1200-1600) $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1323 ± 8	237 ± 20		VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1480^{+100}_{-150}	1030^{+80}_{-170}		¹ ANISOVICH 03	SPEC	
1530^{+90}_{-250}	560 ± 40		² ANISOVICH 03	SPEC	

NODE=M300J98
NODE=M300J98

OCCUR=2

¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M300;LINKAGE=KM

² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$ at rest.

NODE=M300;LINKAGE=MK

X(1420) $I^G(J^{PC}) = 2^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1420 ± 20	160 ± 10		FILIPPI	00	OBLX $0 \bar{p} p \rightarrow \pi^+ \pi^+ \pi^-$

NODE=M300J61
NODE=M300J61

X(1545) $I^G(J^{PC}) = \text{?}^?(?\text{?}^+)$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID		COMMENT
1545 ± 3	6.0 ± 2.5		¹ VLADIMIRSK...08		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

¹ Supersedes VLADIMIRSKII 00.

NODE=M300K07
NODE=M300K07

NODE=M300K07;LINKAGE=VL

X(1575) $I^G(J^{PC}) = \text{?}^?(1^{--})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1576^{+49+98}_{-55-91}	$818^{+22+64}_{-23-133}$		¹ ABLIKIM	06S	BES $J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M300J08
NODE=M300J08

¹ A broad peak observed at $K^+ K^-$ invariant mass. Mass and width above are its pole position. The observed branching ratio is $B(J/\psi \rightarrow X \pi^0) B(X \rightarrow K^+ K^-) = (8.5 \pm 0.6^{+2.7}_{-3.6}) \times 10^{-4}$.

NODE=M300J08;LINKAGE=AB

X(1600) $I^G(J^{PC}) = 2^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)		DOCUMENT ID	TECN	COMMENT
1600 ± 100	400 ± 200		¹ ALBRECHT 91F	ARG	$10.2 e^+ e^- \rightarrow e^+ e^- 2(\pi^+ \pi^-)$

NODE=M300J99
NODE=M300J99

¹ Our estimate.

NODE=M300J99;LINKAGE=A

X(1650) $I^G(J^{PC}) = 0^-(??^-)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1652±7	<50	100	PROKOSHKIN 96	GAM2	32,38 $\pi p \rightarrow \omega \eta n$

NODE=M300J62
NODE=M300J62

X(1730) $I^G(J^{PC}) = ??(??^+)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1731.0±1.2±2.0	3.2 ± 0.8 ± 1.3	58	VLADIMIRSK...07	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 X$

NODE=M300K06
NODE=M300K06

f₂(1750) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1755±10	67 ± 12	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300JAM
NODE=M300JAM

$\Gamma(K\bar{K})$					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
17±5	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	NODE=M300JA1 NODE=M300JA1

$\Gamma(\gamma\gamma)$					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.13±0.04	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	NODE=M300JA2 NODE=M300JA2

$\Gamma(\pi\pi)$					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.3±1.0	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	NODE=M300JA3 NODE=M300JA3

$\Gamma(\eta\eta)$					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.0±0.5	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	NODE=M300JA4 NODE=M300JA4

¹ From analysis of L3 data at 91 and 183–209 GeV.² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.NODE=M300JAM;LINKAGE=SC
NODE=M300JA;LINKAGE=SC

X(1775) $I^G(J^{PC}) = 1^-(?^-)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1763±20	192 ± 60	CONDO 91	SHF	$\gamma p \rightarrow (p\pi^+)(\pi^+\pi^-\pi^-)$	NODE=M300J60 NODE=M300J60
1787±18	118 ± 60	CONDO 91	SHF	$\gamma p \rightarrow n\pi^+\pi^+\pi^-$	OCCUR=2

X(1850 - 3100) $I^G(J^{PC}) = ??(1^{--})$					
$\Gamma(e^+e^-)B(X \rightarrow \text{hadrons})$ (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<120	90	¹ ANASHIN 11	KEDR	$e^+e^- \rightarrow \text{hadrons}$	NODE=M300K28 NODE=M300K28

¹ This limit is center-of-mass energy dependent. We quote the most stringent one.

NODE=M300K28;LINKAGE=AN

X(1855) $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1856.6±5	20 ± 5	BRIDGES	86D	SPEC	0. $\bar{p}d \rightarrow \pi\pi N$

NODE=M300J31
NODE=M300J31

X(1870) $I^G(J^{PC}) = ??(2^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1870±40	250 ± 30	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J45
NODE=M300J45

a₃(1875) $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1874±43±96	385 ± 121 ± 114	CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^-p$

NODE=M300J95
NODE=M300J95

$B(a_3(1875) \rightarrow f_2(1270)\pi)/B(a_3(1875) \rightarrow \rho\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.8 ± 0.2	¹ CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M300B7
 NODE=M300B7

¹ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.

NODE=M300B;LINKAGE=C1

 $B(a_3(1875) \rightarrow \rho_3(1690)\pi)/B(a_3(1875) \rightarrow \rho\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.9 ± 0.3	¹ CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M300B8
 NODE=M300B8

¹ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.

NODE=M300B8;LINKAGE=C1

 $h_1(1900)$ $I^G(J^{PC}) = 0^-(1^{+-})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
$1908 \pm 6_{-4}^{+8}$	$175 \pm 13_{-16}^{+7}$	ABLIKIM	24CB	BES3 $J/\psi \rightarrow \phi\eta\pi^0$

NODE=M300A13
 NODE=M300A13

 $a_1(1930)$ $I^G(J^{PC}) = 1^-(1^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1930_{-70}^{+30}	155 ± 45	ANISOVICH	01F	SPEC $2.0 \bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J92
 NODE=M300J92

 $X(1935)$ $I^G(J^{PC}) = 1^+(1^{-?})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1935 ± 20	215 ± 30	EVANGELIS...	79	OMEG $10,16 \pi^- p \rightarrow \bar{p}pn$

NODE=M300J33
 NODE=M300J33

 $\rho_2(1940)$ $I^G(J^{PC}) = 1^+(2^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1940 ± 40	155 ± 40	¹ ANISOVICH	02	SPEC $0.6-1.9 p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J85
 NODE=M300J85

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J85;LINKAGE=AY

 $\omega_3(1945)$ $I^G(J^{PC}) = 0^-(3^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1945 ± 20	115 ± 22	¹ ANISOVICH	02B	SPEC $0.6-1.9 p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J65
 NODE=M300J65

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J65;LINKAGE=AZ

 $a_2(1950)$ $I^G(J^{PC}) = 1^-(2^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1950_{-70}^{+30}	180_{-70}^{+30}	¹ ANISOVICH	01F	SPEC $1.96-2.41 p\bar{p}$

NODE=M300K24
 NODE=M300K24

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K24;LINKAGE=AN

 $\omega(1960)$ $I^G(J^{PC}) = 0^-(1^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1960 ± 25	195 ± 60	¹ ANISOVICH	02B	SPEC $0.6-1.9 p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J79
 NODE=M300J79

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J79;LINKAGE=AZ

 $b_1(1960)$ $I^G(J^{PC}) = 1^+(1^{+-})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1960 ± 35	230 ± 50	¹ ANISOVICH	02	SPEC $0.6-1.9 p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J67
 NODE=M300J67

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J67;LINKAGE=AY

 $h_1(1965)$ $I^G(J^{PC}) = 0^-(1^{+-})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1965 ± 45	345 ± 75	¹ ANISOVICH	02B	SPEC $0.6-1.9 p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J64
 NODE=M300J64

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J64;LINKAGE=AZ

f₁(1970)		$I^G(J^{PC}) = 0^+(1^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN		
1971±15	240 ± 45	ANISOVICH	00J	SPEC	

NODE=M300J1
NODE=M300J1

X(1970)		$I^G(J^{PC}) = ??(???)$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1970±10	40 ± 20	CHLIAPNIK...	80	HBC	32 $K^+ p \rightarrow 2K_S^0 2\pi X$

NODE=M300J46
NODE=M300J46

X(1975)		$I^G(J^{PC}) = ??(???)$			
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1973±15	80	30	CASO	70	HBC 11.2 $\pi^- p \rightarrow \rho 2\pi$

NODE=M300J47
NODE=M300J47

ω₂(1975)		$I^G(J^{PC}) = 0^-(2^{--})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1975±20	175 ± 25	¹ ANISOVICH	02B	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J81
NODE=M300J81

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J81;LINKAGE=AZ

a₂(1990)		$I^G(J^{PC}) = 1^-(2^{++})$			
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2050±10±40	190 ± 22 ± 100	18k	¹ SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
2003±10±19	249 ± 23 ± 32		LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$

NODE=M300J2
NODE=M300J2

¹ From analysis of L3 data at 183-209 GeV.

NODE=M300J2;LINKAGE=SC

Γ(γγ) Γ(π⁺π⁻π⁰) / Γ(total)					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.11±0.04±0.05	18k	¹ SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

NODE=M300J2G
NODE=M300J2G

¹ From analysis of L3 data at 183-209 GeV.

NODE=M300J2G;LINKAGE=SC

ρ(2000)		$I^G(J^{PC}) = 1^+(1^{--})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2000±30	260 ± 45	¹ BUGG	04C	RVUE	Compilation
~ 1988	~ 244	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J77
NODE=M300J77

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300;LINKAGE=AY

f₂(2000)		$I^G(J^{PC}) = 0^+(2^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2001±10	312 ± 32	ANISOVICH	00J	SPEC	
~ 1996	~ 134	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J25
NODE=M300J25

X(2000)		$I^G(J^{PC}) = 1^-(?^{?+})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1964±35	225 ± 50	¹ ARMSTRONG	93D	E760	$\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
~ 2100	~ 500	¹ ANTIPOV	77	CIBS	- 25 $\pi^- p \rightarrow p\pi^-\rho_3$
2214±15	355 ± 21	² BALTAY	77	HBC	0 15 $\pi^- p \rightarrow \Delta^{++} 3\pi$
2080±40	340 ± 80	KALELKAR	75	HBC	+ 15 $\pi^+ p \rightarrow p\pi^+\rho_3$

NODE=M300K01
NODE=M300K01

¹ Cannot determine spin to be 3.

² BALTAY 77 favors $J^P = ,3^+$.

NODE=M300K01;LINKAGE=AA
NODE=M300K01;LINKAGE=B

X(2000)		$I^G(J^{PC}) = ??(4^{++})$			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1998±3±5	<15	VLADIMIRSK...03	SPEC		$\pi^- p \rightarrow K_S^0 K_S^0 M M$

NODE=M300J97
NODE=M300J97

X(2000) $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$1992 \pm 12 \begin{smallmatrix} +15 \\ -6 \end{smallmatrix}$	$132 \pm 22 \begin{smallmatrix} +17 \\ -4 \end{smallmatrix}$	ABLIKIM	24CB BES3	$J/\psi \rightarrow \phi \eta \pi^0$	NODE=M300A14 NODE=M300A14

η(2010) $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$2010 \begin{smallmatrix} +35 \\ -60 \end{smallmatrix}$	270 ± 60	ANISOVICH	00J SPEC		NODE=M300J5 NODE=M300J5

π_1(2015) $I^G(J^{PC}) = 1^-(1^{-+})$									
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT				
$2014 \pm 20 \pm 16$	$230 \pm 32 \pm 73$	145k	LU	05	B852	18	$\pi^- p \rightarrow \omega \pi^- \pi^0 p$		NODE=M300J05 NODE=M300J05
$2001 \pm 30 \pm 92$	$333 \pm 52 \pm 49$	69k	KUHN	04	B852	18	$\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$		

a_0(2020) $I^G(J^{PC}) = 1^-(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 30	330 ± 75	ANISOVICH	99C SPEC		NODE=M300J6 NODE=M300J6

X(2020) $I^G(J^{PC}) = ??(???)$						
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
2015 ± 3	10 ± 4	FERRER	99	RVUE	$\pi p \rightarrow p p \bar{p} \pi(\pi)$	NODE=M300J34 NODE=M300J34

h_3(2025) $I^G(J^{PC}) = 0^-(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 20	145 ± 30	¹ ANISOVICH	02B SPEC	$0.6-1.9 p \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$	NODE=M300J78 NODE=M300J78
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J78;LINKAGE=AZ

b_3(2030) $I^G(J^{PC}) = 1^+(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2032 ± 12	117 ± 11	¹ ANISOVICH	02 SPEC	$0.6-1.9 p \bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$	NODE=M300J69 NODE=M300J69

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01d, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J69;LINKAGE=AY

a_2(2030) $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2030 ± 20	205 ± 30	¹ ANISOVICH	01F SPEC	$1.96-2.41 p \bar{p}$	NODE=M300K23 NODE=M300K23

¹ From the combined analysis of ANISOVICH 99c, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K23;LINKAGE=AN

a_3(2030) $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2031 ± 12	150 ± 18	¹ ANISOVICH	01F SPEC	$1.96-2.41 p \bar{p}$	NODE=M300K20 NODE=M300K20

¹ From the combined analysis of ANISOVICH 99c, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K20;LINKAGE=AN

η_2(2030) $I^G(J^{PC}) = 0^+(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$2030 \pm 5 \pm 15$	$205 \pm 10 \pm 15$	ANISOVICH	00E SPEC		NODE=M300J8 NODE=M300J8

 $B(a_2 \pi)_{L=0}/B(a_2 \pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT		
0.05 ± 0.03	¹ ANISOVICH	11	SPEC	$0.9-1.94 p \bar{p}$	NODE=M300B1 NODE=M300B1

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B1;LINKAGE=AN

 $B(a_0 \pi)/B(a_2 \pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT		
0.10 ± 0.08	¹ ANISOVICH	11	SPEC	$0.9-1.94 p \bar{p}$	NODE=M300B2 NODE=M300B2

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B2;LINKAGE=AN

B($f_2 \eta$)/B($a_2 \pi$) $L=2$

VALUE	DOCUMENT ID	TECN	COMMENT
0.13±0.06	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

¹ Reanalysis of ADOEIT 96 and ANISOVICH 00E.

NODE=M300B3
NODE=M300B3

NODE=M300B3;LINKAGE=AN

$f_3(2050)$ $I^G(J^{PC}) = 0^+(3^{++})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2048±8	213 ± 34	ANISOVICH	00J	SPEC 2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J7
NODE=M300J7

$f_0(2060)$ $I^G(J^{PC}) = 0^+(0^{++})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
~ 2050	~ 120	¹ OAKDEN	94	RVUE 0.36–1.55 $p\bar{p} \rightarrow \pi\pi$
~ 2060	~ 50	¹ OAKDEN	94	RVUE 0.36–1.55 $p\bar{p} \rightarrow \pi\pi$

NODE=M300J59
NODE=M300J59

OCCUR=2

NODE=M300J;LINKAGE=A

$\pi(2070)$ $I^G(J^{PC}) = 1^-(0^{-+})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2070±35	310 ⁺¹⁰⁰ ₋₅₀	ANISOVICH	01F	SPEC 2.0 $p\bar{p} \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J91
NODE=M300J91

X(2080) $I^G(J^{PC}) = ??(???)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2080±10	110 ± 20	KREYMER	80	STRC 13 $\pi^- d \rightarrow p\bar{p}n(n_s)$

NODE=M300J35
NODE=M300J35

X(2080) $I^G(J^{PC}) = ??(3^{-?})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2080±10	190 ± 15	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p\bar{p}n$

NODE=M300J37
NODE=M300J37

$K_1(2085)$ $I^G(J^{PC}) = ??(1^{+?})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2084 ⁺⁴ ₋₂ ±9	58 ⁺⁴ ₋₃ ±25	^{1,2} ABLIKIM	23BG	BES3 $e^+e^- \rightarrow pK^-\bar{\Lambda}$
2075±12±5	90 ± 35 ± 9	³ ABLIKIM	04J	BES2 $J/\psi \rightarrow K^-\rho\bar{\Lambda}$

NODE=M300J01
NODE=M300J01

¹ The reported mass and width are the pole positions in the complex (M, Γ) plane.

² Signal observed with a statistical significance $>20\sigma$ comes from 3883 candidate events. Spin parity determined to be $J^P = 1^+$ with a statistical significance $>5\sigma$ over $0^-, 1^-, 2^+$ hypotheses, and in the range within 3.1–7.5 σ with respect to 2^- .

³ From a fit in the region $M_{p\bar{\Lambda}} - M_p - M_{\Lambda} < 150$ MeV. S-wave in the $p\bar{\Lambda}$ system preferred.

A similar near-threshold enhancement in the $p\bar{\Lambda}$ system is observed in $B^+ \rightarrow p\bar{\Lambda}D^0$ by CHEN 11F.

NODE=M300J01;LINKAGE=A
NODE=M300J01;LINKAGE=B

NODE=M300J01;LINKAGE=AB

$a_1(2095)$ $I^G(J^{PC}) = 1^-(1^{++})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2096±17±121	451 ± 41 ± 81	69k	KUHN	04 B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^-p$

NODE=M300J04
NODE=M300J04

B($a_1(2095) \rightarrow f_1(1285)\pi$) / B($a_1(2095) \rightarrow a_1(1260)$)

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
3.18±0.64	69k	KUHN	04	B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^-p$

NODE=M300B03
NODE=M300B03

$\eta(2100)$ $I^G(J^{PC}) = 0^+(0^{-+})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2050 ⁺³⁰⁺⁷⁵ ₋₂₄₋₂₆	250 ⁺³⁶⁺¹⁸¹ ₋₃₀₋₁₆₄	¹ ABLIKIM	16N	BES3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2103±50	187 ± 75	586	² BISELLO	89B DM2 $J/\psi \rightarrow 4\pi\gamma$

NODE=M300J48
NODE=M300J48

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma \phi \phi$, for which the primary signal is $\eta(2225) \rightarrow \phi \phi$, and that also finds significant signals for for 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M300J48;LINKAGE=A

² ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.

NODE=M300J;LINKAGE=A1

X(2100) $I^G(J^{PC}) = ??(0^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2100 ± 40	250 ± 40	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110) $I^G(J^{PC}) = 1^+(3^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p} p n$

NODE=M300J36
NODE=M300J36

X(2120) $I^G(J^{PC}) = ??(0^{??})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2122.4 ± 6.7 ^{+4.7} _{-2.7}	83 ± 16 ⁺³¹ ₋₁₁	647	ABLIKIM	11C	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M300A07
NODE=M300A07

$\omega(2120)$ or $\phi(2120)$ $I^G(J^{PC}) = 0^-(?^{- -})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2119 ± 11 ± 15	69 ± 30 ± 5	¹ ABLIKIM	24AA	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M300K43
NODE=M300K43

¹ From a fit with more than 5σ to the Born cross section line shapes of $e^+ e^- \rightarrow \rho \pi$ and $e^+ e^- \rightarrow \rho(1450) \pi$.

NODE=M300K43;LINKAGE=A

$f_2(2140)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2141 ± 12	49 ± 28	389	GREEN	86	MPSF 400 $p A \rightarrow 4K X$

NODE=M300J50
NODE=M300J50

X(2150) $I^G(J^{PC}) = ??(2^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2150 ± 10	260 ± 10	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J38
NODE=M300J38

$a_2(2175)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2175 ± 40	310 ⁺⁹⁰ ₋₄₅	ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$

NODE=M300J88
NODE=M300J88

$\eta(2190)$ $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2190 ± 50	850 ± 100	BUGG	99	BES	

NODE=M300J13
NODE=M300J13

$\omega_2(2195)$ $I^G(J^{PC}) = 0^-(2^{- -})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2195 ± 30	225 ± 40	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J82
NODE=M300J82

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J82;LINKAGE=AZ

X(2210) $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ⁺⁷⁹ ₋₂₁	203 ⁺⁴³⁷ ₋₈₇	EVANGELIS...	79B	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
2207 ± 22	130	CASO	70	HBC	11.2 $\pi^- p$

NODE=M300J51
NODE=M300J51

$X_2(2210)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ± 60	360 ± 120	¹ KLEMP	22	RVUE	$J/\psi \rightarrow \gamma \pi^0 \pi^0,$ $\gamma K_S^0 K_S^0$

NODE=M300A05
NODE=M300A05

¹ Fit of the tensor partial waves from BES3 in the multipole basis. Might be a cluster of $J^{PC} = 2^{++}$ resonances. The ratio of decay widths $KK^-/\pi\pi$ is 0.23 ± 0.05 .

NODE=M300A05;LINKAGE=A

$h_1(2215)$		$I^G(J^{PC}) = 0^-(1^{+-})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2215 ± 40	325 ± 55	¹ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J27
NODE=M300J27

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J27;LINKAGE=AZ

$\rho_2(2225)$		$I^G(J^{PC}) = 1^+(2^{--})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2225 ± 35	335 ⁺¹⁰⁰ ₋₅₀	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J70
NODE=M300J70

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J70;LINKAGE=AY

$\rho_4(2230)$		$I^G(J^{PC}) = 1^+(4^{--})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2230 ± 25	210 ± 30	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J74
NODE=M300J74

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J74;LINKAGE=AY

$b_1(2240)$		$I^G(J^{PC}) = 1^+(1^{+-})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2240 ± 35	320 ± 85	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J87
NODE=M300J87

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J87;LINKAGE=AY

$f_2(2240)$		$I^G(J^{PC}) = 0^+(2^{++})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2240 ± 15	241 ± 30	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$

NODE=M300K26
NODE=M300K26

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2226 ~ 226 HASAN 94 RVUE $p\bar{p} \rightarrow \pi\pi$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K26;LINKAGE=AN

$b_3(2245)$		$I^G(J^{PC}) = 1^+(3^{+-})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
2245 ± 50	320 ± 70	¹ BUGG	04C	RVUE

NODE=M300K10
NODE=M300K10

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

$\eta_2(2250)$		$I^G(J^{PC}) = 0^+(2^{-+})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
2248 ± 20	280 ± 20	ANISOVICH	00I	SPEC
2267 ± 14	290 ± 50	ANISOVICH	00J	SPEC

NODE=M300J17
NODE=M300J17

$\pi_4(2250)$		$I^G(J^{PC}) = 1^-(4^{-+})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 15	215 ± 25	ANISOVICH	01F	SPEC 2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J73
NODE=M300J73

$\omega_4(2250)$		$I^G(J^{PC}) = 0^-(4^{--})$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 30	150 ± 50	¹ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J84
NODE=M300J84

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250)$ $I^G(J^{PC}) = 0^-(5^-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 70	320 ± 95	¹ BUGG	04	RVUE

NODE=M300K11
NODE=M300K11

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300;LINKAGE=AZ

$\omega_3(2255)$ $I^G(J^{PC}) = 0^-(3^-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 15	175 ± 30	¹ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J66
NODE=M300J66

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J66;LINKAGE=AZ

$a_4(2255)$ $I^G(J^{PC}) = 1^-(4^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2237 ± 5	291 ± 12	UMAN	06	E835 5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2255 ± 40	330 ⁺¹¹⁰ ₋₅₀	¹ ANISOVICH	01F	SPEC 1.96–2.41 $\bar{p}p$

NODE=M300K21
NODE=M300K21

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K21;LINKAGE=AN

$a_2(2255)$ $I^G(J^{PC}) = 1^-(2^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 20	230 ± 15	¹ ANISOVICH	01G	SPEC 1.96–2.41 $\bar{p}p$

NODE=M300K22
NODE=M300K22

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K22;LINKAGE=AN

$X(2260)$ $I^G(J^{PC}) = 0^+(4^?)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2260 ± 20	400 ± 100	EVANGELIS...	79	OMEG 10,16 $\pi^-p \rightarrow \bar{p}pn$

NODE=M300J40
NODE=M300J40

$\rho(2270)$ $I^G(J^{PC}) = 1^+(1^-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2265 ± 40	325 ± 80	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2280 ± 50	440 ± 110	ATKINSON	85	OMEG 20–70 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$

NODE=M300J86
NODE=M300J86

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J86;LINKAGE=AY

$a_1(2270)$ $I^G(J^{PC}) = 1^-(1^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2270 ⁺⁵⁵ ₋₄₀	305 ⁺⁷⁰ ₋₄₀	ANISOVICH	01F	SPEC 2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J72
NODE=M300J72

$h_3(2275)$ $I^G(J^{PC}) = 0^-(3^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2275 ± 25	190 ± 45	¹ ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J28
NODE=M300J28

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J28;LINKAGE=AZ

$a_3(2275)$ $I^G(J^{PC}) = 1^-(3^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2275 ± 35	350 ⁺¹⁰⁰ ₋₅₀	¹ ANISOVICH	01G	SPEC 1.96–2.41 $\bar{p}p$

NODE=M300K19
NODE=M300K19

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K19;LINKAGE=AN

$\pi_2(2285)$ $I^G(J^{PC}) = 1^-(2^-)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2285 ± 20 ± 25	250 ± 20 ± 25	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300K25
NODE=M300K25

¹ Reanalysis of ADOEIT 96 and ANISOVICH 00E.

NODE=M300K25;LINKAGE=AN

$\omega_3(2285)$ $I^G(J^{PC}) = 0^-(3^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2278±28	224 ± 50	¹ BUGG	04A	RVUE
2285±60	230 ± 40	² ANISOVICH	02B	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.NODE=M300J83;LINKAGE=BU
NODE=M300J83;LINKAGE=AZ² From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

$\omega(2290)$ $I^G(J^{PC}) = 0^-(1^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2290±20	275 ± 35	¹ BUGG	04A	RVUE

NODE=M300J02
NODE=M300J02¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J02;LINKAGE=BU

$f_2(2295)$ $I^G(J^{PC}) = 0^+(2^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2293±13	216 ± 37	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$

NODE=M300K27
NODE=M300K27¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K27;LINKAGE=AN

$f_3(2300)$ $I^G(J^{PC}) = 0^+(3^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2334±25	200 ± 20	¹ BUGG	04A	RVUE

NODE=M300J19
NODE=M300J19¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J19;LINKAGE=BU

$f_1(2310)$ $I^G(J^{PC}) = 0^+(1^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2310±60	255 ± 70	ANISOVICH	00J	SPEC

NODE=M300J23
NODE=M300J23

$\eta(2320)$ $I^G(J^{PC}) = 0^+(0^{-+})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2320±15	230 ± 35	¹ ANISOVICH	00M	SPEC

NODE=M300J18
NODE=M300J18¹ From the combined analysis of $\bar{p}p \rightarrow \eta\eta\eta$ from ANISOVICH 00M and $\bar{p}p \rightarrow \eta\pi^0\pi^0$ from ANISOVICH 00J.

NODE=M300;LINKAGE=B

$\eta_4(2330)$ $I^G(J^{PC}) = 0^+(4^{-+})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2328±38	240 ± 90	ANISOVICH	00J	SPEC 2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J22
NODE=M300J22

$\omega(2330)$ $I^G(J^{PC}) = 0^-(1^{--})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2330±30	435 ± 75	ATKINSON	88	OMEG 25–50 $\gamma p \rightarrow \rho^\pm \rho^0 \pi^\mp$

NODE=M300J53
NODE=M300J53

$X(2340)$ $I^G(J^{PC}) = ???(???)$

MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2340±20	180 ± 60	126	¹ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p5\pi$

NODE=M300J54
NODE=M300J54¹ Dominant decay into $\rho^0 \rho^0 \pi^+$. BALTAY 78 finds confirmation in $2\pi^+ \pi^- 2\pi^0$ events which contain $\rho^+ \rho^0 \pi^0$ and $2\rho^+ \pi^-$.

NODE=M300J;LINKAGE=B1

$\pi(2360)$ $I^G(J^{PC}) = 1^-(0^{-+})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2360±25	$300 \begin{smallmatrix} +100 \\ -50 \end{smallmatrix}$	ANISOVICH	01F	SPEC 2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J90
NODE=M300J90

X(2360) $I^G(J^{PC}) = ??(4^{+?})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2360 ± 10	430 ± 30	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p \bar{p} n$
2356 ± 7 ± 15	304 ± 28 ± 54	¹ ABLIKIM	23AY	BES3 $e^+ e^- \rightarrow (\Lambda \bar{\Lambda}) \eta$

¹ Assuming $J^{PC} = 1^{--}$.

NODE=M300J42
 NODE=M300J42

NODE=M300J42;LINKAGE=A

X(2440) $I^G(J^{PC}) = ??(5^{-?})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2440 ± 10	310 ± 20	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J43
 NODE=M300J43

$a_6(2450)$ $I^G(J^{PC}) = 1^-(6^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2450 ± 130	400 ± 250	CLELAND	82B	SPEC 50 $\pi p \rightarrow K_S^0 K^\pm p$

NODE=M300K12
 NODE=M300K12

X(2540) $I^G(J^{PC}) = 0^+(0^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2539 ± 14 ⁺³⁸ ₋₁₄	274 ⁺⁷⁷⁺¹²⁶ ₋₆₁₋₁₆₃	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300K30
 NODE=M300K30

$\Gamma(\gamma\gamma) \times B(K\bar{K})$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
40 ⁺⁹⁺¹⁷ ₋₇₋₄₀	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300K3G
 NODE=M300K3G

X(2600) $I^G(J^{PC}) = ??(???)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2618.3 ± 2.0 ^{+16.3} _{-1.4}	195 ± 5 ⁺²⁶ ₋₁₇	ABLIKIM	22G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M300A01
 NODE=M300A01

$B(J/\psi \rightarrow \gamma X(2600)) \times B(X(2600) \rightarrow f_0(1500) \eta') \times B(f_0(1500) \rightarrow \pi^+ \pi^-)$

VALUE (units 10 ⁻⁵)	DOCUMENT ID	TECN	COMMENT
3.09 ± 0.21 ^{+1.14} _{-0.77}	¹ ABLIKIM	22G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M300A02
 NODE=M300A02

¹ The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass 1540.2 ± 7.0 ^{+36.3}_{-6.1} MeV and width 157 ± 19 ⁺¹¹₋₇₇ MeV.

NODE=M300A02;LINKAGE=A

$B(J/\psi \rightarrow \gamma X(2600)) \times B(X(2600) \rightarrow X(1540) \eta') \times B(X(1540) \rightarrow \pi^+ \pi^-)$

VALUE (units 10 ⁻⁵)	DOCUMENT ID	TECN	COMMENT
2.69 ± 0.19 ^{+0.38} _{-1.21}	¹ ABLIKIM	22G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M300A03
 NODE=M300A03

¹ The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass 1540.2 ± 7.0 ^{+36.3}_{-6.1} MeV and width 157 ± 19 ⁺¹¹₋₇₇ MeV.

NODE=M300A03;LINKAGE=A

$K_0^*(2600)$ $I(J^P) = 1/2(0^+)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2662 ± 59 ± 201	480 ± 47 ± 72	¹ AAIJ	23AH	LHCB $B^+ \rightarrow K^+ (K_S^0 K \pi)$

NODE=M300A09
 NODE=M300A09

¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$

NODE=M300A09;LINKAGE=A

X(2632) $I^G(J^{PC}) = ??(???)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2635.2 ± 3.3		¹ EVDOKIMOV	04	SELX $X(2632) \rightarrow D_S^+ \eta$
2631.6 ± 2.1	< 17	² EVDOKIMOV	04	SELX $X(2632) \rightarrow D_S^0 K^+$

NODE=M300J03
 NODE=M300J03

OCCUR=2

¹ From a mass difference to D_S^+ of 666.9 ± 3.3 MeV.

² From a mass difference to D_S^0 of 767.0 ± 2.0 MeV.

NODE=M300J03;LINKAGE=EV
 NODE=M300J03;LINKAGE=ED

B(X(2632) → D⁰ K⁺)/B(X(2632) → D_s⁺ η)

VALUE	DOCUMENT ID	TECN
0.14 ± 0.06	¹ EVDOKIMOV 04	SELX

¹ Possible interpretation of this decay pattern is discussed by YASUI 07.

NODE=M300B01
NODE=M300B01

NODE=M300B01;LINKAGE=YA

X(2680) I^G(J^{PC}) = ??(???)

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2676 ± 27	150	CASO	70 HBC	11.2 π ⁻ p → ρ ⁻ π ⁺ π ⁻ p

NODE=M300J55
NODE=M300J55

X(2710) I^G(J^{PC}) = ??(6⁺?)

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2710 ± 20	170 ± 40	ROZANSKA	80 SPRK	18 π ⁻ p → p p̄ n

NODE=M300J44
NODE=M300J44

X(2750) I^G(J^{PC}) = ??(7⁻?)

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2747 ± 32	195 ± 75	DENNEY	83 LASS	10 π ⁺ p → K ⁺ K ⁻ π ⁺ p

NODE=M300J56
NODE=M300J56

f₆(3100) I^G(J^{PC}) = 0⁺(6⁺++)

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
3100 ± 100	700 ± 130	BINON	05 GAMS	33 π ⁻ p → η η n

NODE=M300J06
NODE=M300J06

X(3250) I^G(J^{PC}) = ??(???) 3-Body Decays

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
3250 ± 8 ± 20	45 ± 18	ALEEV	93 BIS2	X(3250) → Λ p̄ K ⁺
3265 ± 7 ± 20	40 ± 18	ALEEV	93 BIS2	X(3250) → Λ̄ p̄ K ⁻

NODE=M300J57
NODE=M300J57

OCCUR=2

X(3250) I^G(J^{PC}) = ??(???) 4-Body Decays

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
3245 ± 8 ± 20	25 ± 11	ALEEV	93 BIS2	X(3250) → Λ p̄ K ⁺ π [±]
3250 ± 9 ± 20	50 ± 20	ALEEV	93 BIS2	X(3250) → Λ̄ p̄ K ⁻ π [∓]
3270 ± 8 ± 20	25 ± 11	ALEEV	93 BIS2	X(3250) → K _S ⁰ p̄ p̄ K [±]

NODE=M300J58
NODE=M300J58

OCCUR=2

OCCUR=3

X(3350) I^G(J^{PC}) = ??(???)

MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3350 ⁺¹⁰ ₋₂₀ ± 20	70 ⁺⁴⁰ ₋₃₀ ± 40	50 ± 10	¹ GABYSHEV 06A	BELL	B ⁻ → Λ _c ⁺ p̄ π ⁻

NODE=M300J09
NODE=M300J09

¹ A similar enhancement in the Λ_c⁺ p̄ final state is also reported by BABAR collaboration in AUBERT 10H.

NODE=M300J09;LINKAGE=AU

ψ(3760) I^G(J^{PC}) = ??(1⁻-)

MASS (MeV)	DOCUMENT ID	TECN	COMMENT
3751.9 ± 3.8 ± 2.8	¹ ABLIKIM 24BO BES3	BES3	e ⁺ e ⁻ → hadrons
~ 3740	¹ ABLIKIM 24E BES3	BES3	e ⁺ e ⁻ → light hadrons

NODE=M300A10
NODE=M300A10

¹ Fit to cross sections for √s = 3645 to 3871 MeV.

NODE=M300A10;LINKAGE=A

ψ(3780) I^G(J^{PC}) = ??(1⁻-)

MASS (MeV)	DOCUMENT ID	TECN	COMMENT
3778.7 ± 0.5 ± 0.3	¹ ABLIKIM 24BO BES3	BES3	e ⁺ e ⁻ → hadrons
~ 3780	¹ ABLIKIM 24E BES3	BES3	e ⁺ e ⁻ → light hadrons

NODE=M300A11
NODE=M300A11

¹ Fit to cross sections for √s = 3645 to 3871 MeV.

NODE=M300A11;LINKAGE=A

ψ(3810) I^G(J^{PC}) = ??(1⁻-)

MASS (MeV)	DOCUMENT ID	TECN	COMMENT
3804.5 ± 0.9 ± 0.9	¹ ABLIKIM 24BO BES3	BES3	e ⁺ e ⁻ → hadrons
~ 3806	¹ ABLIKIM 24E BES3	BES3	e ⁺ e ⁻ → light hadrons

NODE=M300A12
NODE=M300A12

¹ Fit to cross sections for $\sqrt{s} = 3645$ to 3871 MeV.

$h_c(4000)$		$I^G(J^{PC}) = 0^-(1^{+-})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
4000^{+17+29}_{-14-22}	184^{+71+97}_{-45-61}	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*\pm} D^{\mp} K^+$	

NODE=M300A12;LINKAGE=A

NODE=M300A15
NODE=M300A15

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M300A15;LINKAGE=A

$\chi_{c1}(4010)$		$I^G(J^{PC}) = 0^+(1^{++})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$4012.5^{+3.6+4.1}_{-3.9-3.7}$	$62.7^{+7.0+6.4}_{-6.4-6.6}$	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*\pm} D^{\mp} K^+$	

NODE=M300A17
NODE=M300A17

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M300A17;LINKAGE=A

$h_c(4300)$		$I^G(J^{PC}) = 0^-(1^{+-})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$4307.3^{+6.4+3.3}_{-6.6-4.1}$	58^{+28+28}_{-16-25}	1.6k	¹ AAIJ	24AB LHCB	$B^+ \rightarrow D^{*\pm} D^{\mp} K^+$	

NODE=M300A16
NODE=M300A16

¹ From a simultaneous amplitude analysis of $B^+ \rightarrow D^{*+} D^- K^+$, $B^+ \rightarrow D^{*-} D^+ K^+$ and their c.c.

NODE=M300A16;LINKAGE=A

$\psi(4500)$		$I^G(J^{PC}) = 0^-(1^{--})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$4544.2 \pm 18.7 \pm 1.7$	$116.1 \pm 33.5 \pm 1.7$		¹ ABLIKIM	24D BES3	$e^+ e^- \rightarrow \omega \gamma J/\psi$	
$4469.1 \pm 26.2 \pm 3.6$	$246.3 \pm 36.7 \pm 9.4$		² ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$	
$4484.7 \pm 13.3 \pm 24.1$	$111.1 \pm 30 \pm 15.2$		³ ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$	

NODE=M300K39
NODE=M300K39

¹ Assuming one single Breit-Wigner resonance in $\omega \chi_{c2}(1P)$ ($\chi_{c2} \rightarrow \gamma J/\psi$). Measured $\Gamma_{ee} \cdot B(\omega \chi_{c1}(1P)) = 1.86 \pm 0.32 \pm 0.13$ eV.

NODE=M300K39;LINKAGE=C

² From a cross-section measurement of $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. $\Gamma(e^+ e^-) \cdot B(D^{*0} D^{*-} \pi^+) = 107\text{--}1744$ eV depending on solutions I – VIII with the same fit qualities. The two other resonances have masses (widths) 4209.6 ± 7.5 (81.6 ± 19.9) MeV and 4675.3 ± 29.7 (218.3 ± 73.5) MeV.

NODE=M300K39;LINKAGE=A

³ ABLIKIM 22AU cross sections analysis of the process $e^+ e^- \rightarrow K^+ K^- J/\psi$ at c.m. energies 4.127–4.600 GeV from 15.6 fb^{-1} of data.

NODE=M300K39;LINKAGE=B

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KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
PROKOSHKIN	96	PD 41 247	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=45182
		Translated from DANS 348 481.			
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)	REFID=43668
		Translated from YAF 56 100.			
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43596
ALBRECHT	91F	ZPHY C50 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41658
CONDO	91	PR D43 2787	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=41588
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
ATKINSON	88	ZPHY C38 535	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=40556
DAFTARI	87	PRL 58 859	I.K. Daftari <i>et al.</i>	(SYRA)	REFID=40412
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
BRIDGES	86D	PL B180 313	D.L. Bridges <i>et al.</i>	(SYRA, BNL, CASE+)	REFID=21984
GREEN	86	PRL 56 1639	D.R. Green <i>et al.</i>	(FNAL, ARIZ, FSU+)	REFID=21872
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=22000
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
ASTON	81B	NP B189 205	D. Aston <i>et al.</i>	(BONN, CERN, EPOL, GLAS+)	REFID=11553
ARESTOV	80	IHEP 80-165	Y.I. Arestov <i>et al.</i>	(SERP)	REFID=22312
CHLIAPNIK...	80	ZPHY C3 285	P.V. Chliapnikov <i>et al.</i>	(SERP, BRUX, MONS)	REFID=21996
KREYMER	80	PR D22 36	A.E. Kreymer <i>et al.</i>	(IND, PURD, SLAC+)	REFID=21970
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	REFID=21774
EVANGELIS...	79	NP B153 253	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21966
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21967
BALTAY	78	PR D17 52	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21569
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU)	REFID=20847
BALTAY	75	PRL 35 891	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21994
KALELKHAR	75	Thesis Nevis 207	M.S. Kalelkar	(COLU)	REFID=21564
CASO	70	LCN 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=20590